TECHNICAL DATA

TM 11-6625-280-15

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

See C1, 2, 4, 5-

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ORGANIZATIONAL, FIELD AND DEPOT MAINTENANCE

SIGNAL GENERATORS AN/URM-49 AND AN/URM-49A

TECHNICAL DATA

191/69

HEADQUARTERS, DEPARTMENT OF THE ARMY

AUGUST 1959

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., *4 August 1959*

TM 11-6625-280-15 (a reprint of Air Force-Navy Publication AN 16-30URM 49-3, 15 December 1950 (AN 16-35TS418-3, 15 May 1949), including revisions of 15 October 1952, and 15 May 1954) is published for the use of Army personnel.

[AG 413.44 (17 Jul 59)]

By Order of *Wilber M. Brucker*, Secretary of the Army:

L. L. LEMNITZER,
General, United States Army,
Chief of Staff.

Official:

R. V. LEE,
Major General, United States Army,
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11-57 (2)	AE) (2)
11-97 (2)	11-587 (2)
11-98 (2)	11-592 (2)
11-117 (2)	11-597 (2)

NG: State AG (3).

USAR: None.

For explanation of abbreviations used, see AR 320-50.

TECHNICAL DATA

TECHNICAL MANUAL

Organizational, Field and Depot Maintenance Manual

SIGNAL GENERATORS AN/URM-49, AN/URM-49A, AN/URM-49B, AND AN/URM-49C

TM 11-6625-280-15
CHANGES No. 5

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., *15 April 1963*

TM 11-6625-280-15, 4 August 1959, is changed as follows:

Note. The parenthetical reference to previous Changes (example: "page 3 of C 1") indicates that pertinent material was published in those Changes.

Page iv. Delete: "UNSATISFACTORY REPORT" and the two paragraphs below.

Page 1-1. After paragraph 2, add paragraphs 2.1 and 2.2:

2.1. Index of Publications

Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to this equipment. DA Pam 310-4 is an index of current technical manuals, technical bulletins, supply bulletins, lubrication orders, and modification work orders that are available through publications supply channels. The index lists the individual parts (-10, -20, -35P, etc.) and the latest changes to and revisions of each equipment publication.

2.2. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Use equipment forms and records in accordance with instructions in TM 38-750.

b. Report of Damaged or Improper Shipment. Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment) as prescribed in AR 700-58 (Army), NAVSANDA Publications 378 (Navy), and AFR 71-4 (Air Force).

c. Comments on Manual. Forward all comments on this publication direct to: Commanding Officer, U.S. Army Electronics Materiel Support Agency, ATTN: SELMS-MP, Fort Monmouth, N. J. DA Form 1598 (Record of Comments on Publications), DA Form 2496 (Disposition Form), or letter may be used.

Page 4-0. Delete paragraph 2 and substitute:

2. Scope of Operator's Maintenance

The maintenance duties assigned to the operator of Signal Generator AN/URM-49(*) are listed below together with a reference to the paragraphs covering the specific maintenance function. The duties assigned do not require tools or test equipment other than those issued with the set.

a. Daily maintenance service and inspection (par. 2.3).

b. Weekly maintenance service and inspection (par. 2.4).

c. Cleaning (par. 2.5).

Page 4-1. Add paragraphs 2.1 through 2.8:

2.1. Preventive Maintenance

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble, to reduce downtime, and to assure that the equipment is serviceable.

a. Systematic Care. The procedures given in paragraphs 2.3 through 2.8 cover systematic care essential to proper upkeep and operation of the equipment. The cleaning operations (par. 2.5) should be performed once a day. If the equipment is not used daily, however, the cleaning operations must be performed before operation, after any extended shutdown, or once a week while the equipment is kept in

standby condition. The other items must be checked before the equipment is placed in operation after a shutdown, during operation, or after it is turned off, as specified in the applicable paragraph.

b. Maintenance Service and Inspection. The maintenance service and inspection charts (pars. 2.3 and 2.4) outline inspections to be made at daily and weekly intervals. These inspections are made to determine that the equipment is in good general (physical) condition, in good operating condition, and likely to remain combat serviceable. To assist operators in maintaining combat serviceability, the charts indicate what to inspect, how to inspect, and what the normal conditions are; the *references* column lists the paragraph that contains additional information. If the defect cannot be remedied by the operator, higher echelon maintenance or repair is required. Records and reports of these inspections must be made in accordance with TM 38–750.

2.2. Maintenance Service and Inspections Periods

Maintenance service and inspection of Signal Generator AN/URM–49(*) is required daily and weekly. Paragraphs 2.3 and 2.4 specify the items to be inspected and serviced. In addition to the routine services and inspection, the equipment should be reinspected and serviced immediately before going out on a mission and as soon after completion of the mission as possible.

2.3. Daily Maintenance Service and Inspection Chart

Item No.	Procedure		References
	Item	Normal condition or result	
2	INSTALLATION: Inspect the signal generator for proper installation.	Installation is in accordance with paragraph 3*a*, section II.	
3	CLEANLINESS: Inspect the equipment for cleanliness.	The signal generator must be clean and dry inside and out; free of grease, dirt, rust, corrosion, and fungus.	Section IV, paragraph 2.5.
8	METER: Check meter for broken glass window.	Meter window should be free of cracks.	
9	LAMPS: Inspect the signal generator for burned-out pilot lamps.	Pilot lamps should light when the signal generator power is turned on.	
11	FUSES: Check for proper fuses.	The fuses in use should be of the indicated values and located as follows: Front panel: 2 each 3 amperes.	Table 4–1.
17	OPERATIONAL CHECK: During operation, be alert for any unusual performance or condition. (page 2–4, par. 3).	Refer to page 2–4, paragraph 3.	Steps 1 and 2, table 4–1.

2.4. Weekly Maintenance Service and Inspection Chart

Item No.	Procedure		References
	Item	Normal condition or result	
1	COMPLETENESS: Inspect the equipment for completeness.	The equipment must be complete (appx III).	
7	CONTROLS: Inspect switches, knobs, jacks, and connectors for looseness, binding, and scraping.	Controls should not bind, scrape, or be excessively loose.	

Item No.	Procedure		References
	Item	Normal condition or result	
14	CONNECTORS: Inspect connectors for proper contact.	All connectors should fit snugly and make good contact with the mating cables.	
16	CORDS AND CABLES: Inspect power cord and signal cables for cuts, cracks, strain, and fraying.	Cords and cables should be free of cuts, cracks, strain, and fraying.	

2.5. Cleaning

Inspect the exterior of the set. The exterior surfaces should be clean, free of dust, dirt, grease, and fungus.

a. Remove dust and loose dirt with a clean soft cloth.

Warning: **Cleaning compound is flammable and its fumes are toxic. Provide adequate ventilation. *Do not* use near a flame.**

b. Remove grease, fungus, and ground-in dirt from the case; use a cloth dampened (not wet) with cleaning compound.

c. Remove dust or dirt from plugs and jacks with a brush.

Caution: **Do not press on the meter face (glass) when cleaning; the meter may become damaged.**

d. Clean the front panel, meter, and control knobs; use a soft clean cloth. If dirt is difficult to remove, use mild soap and water.

2.6. Monthly Organizational Maintenance

Monthly maintenance on Signal Generator AN/URM–49(*) will be scheduled in accordance with the requirements of TM 38–750. If the equipment is part of a vehicular installation, the monthly maintenance should be scheduled concurrently with the periodic service schedule of the carrying vehicle to reduce out-of-service time to a minimum. All deficiencies or shortcomings will be recorded, and those not corrected during the inspection and service will be immediately reported to higher echelon, using forms and procedures specified by TM 38–750. Equipment that has a deficiency that cannot be corrected by second echelon should be deadlined in accordance with TM 38–750. Perform all the services listed in the monthly maintenance and inspection chart (par. 2.7) in the sequence listed. Whenever a *normal condition or result* is not observed, take corrective action in accordance with the paragraph listed under *references*.

2.7. Monthly Maintenance Service and Inspection Chart

Item No.	Procedure		References
	Item	Normal condition or result	
1	COMPLETENESS: Inspect the equipment for completeness.	The equipment must be complete (appx III).	
2	INSTALLATION: Inspect the signal generator for proper installation.	Installation is in accordance with paragraph 3*a*, section II.	
3	CLEANLINESS: Inspect the equipment for cleanliness.	The signal generator must be clean and dry inside and out; free of grease, dirt, rust, corrosion, and fungus.	Section IV, paragraph 2.5.
4	PRESERVATION: Inspect surfaces of signal generator for rust and corrosion.	Painted surfaces must be free of bare spots, rust, and corrosion.	Section IV, paragraph 2.8.

2.7. Monthly Maintenance Service and Inspection Chart—(Cont.)

Item No.	Procedure		References
	Item	Normal condition or result	
5	PUBLICATIONS: Check to see that pertinent publications are available.	*a.* Operator's manual must be complete and in usable condition without missing pages. *b.* All changes pertinent to the equipment are on hand (DA Pam 310–4). *c.* Organizational maintenance manual is complete and in usable condition.	DA Pam 310–4 for requirements.
6	MODIFICATION WORK ORDERS: Check DA Pam 310–4 to determine if new applicable MWO's have been published.	All URGENT MWO's have been applied to the equipment. All ROUTINE MWO's have been scheduled.	
7	CONTROLS: Inspect switches, knobs, jacks, and connectors for looseness, binding, and scraping.	Controls should not bind, scrape, or be excessively loose.	
8	METER: Check meter for broken glass window.	Meter window should be free of cracks.	
9	LAMPS: Inspect the signal generator for burned-out pilot lamps.	Pilot lamps should light when the signal generator power is turned on.	
10	PLUCKOUT ITEMS: Inspect clamps and seating of all pluckout items.	All items should be properly seated and clamps in proper position and correctly tightened.	
11	FUSES: Check for proper fuses.	The fuses in use should be of the indicated values and located as follows: Front panel: 2 each 3 amperes.	Table 4–1.
12	RESISTORS AND CAPACITORS: Inspect resistors and capacitors for cracks, chipping, or blistering.	Resistors and capacitors should be free of cracks, chipping, or blistering.	
13	INSULATORS AND BUSHINGS: Inspect for cracks, chipping, or excessive wear.	Insulators and bushings should be free from chipping, cracks, or excessive wear.	
14	CONNECTORS: Inspect connectors for proper contact.	All connectors should fit snugly and make good contact with the mating cables.	Refer to higher echelon.
15	VARIABLE CAPACITORS: Inspect variable capacitors for dirt, corrosion, or deformed plates.	Variable capacitors should be clean and free of corrosion; plates should not be deformed.	
16	CORDS AND CABLES: Inspect power cord and signal cables for cuts, cracks, strain, and fraying.	Cords and cables should be free of cuts, cracks, strain, and fraying.	
17	OPERATIONAL CHECK: During operation, be alert for any unusual performance or operation. (page 2–4, par. 3).	Refer to page 2–4, paragraph 3.	Steps 1 and 2, table 4–1.

Item No.	Procedure		References
	Item	Normal condition or result	
18	SPARE PARTS: Check all spare parts for general condition and method of storage.	All spare parts must be in good condition and properly stored. There should be no evidence of overstock, and all shortages will be on valid requisitions.	Appendix III.

2.8. Cleaning and Touchup Painting Instructions

Remove rust and corrosion from metal surfaces by lightly sanding them with fine sandpaper. Brush two thin coats of paint on the bare metal to protect it from further corrosion. Refer to applicable cleaning and refinishing practices specified in TM 9–213.

Page 4–25. Add section IV.1 after section IV.

SECTION IV.1 DEPOT INSPECTION STANDARDS

1. Applicability of Depot Inspection Standards

The tests outlined in this section are designed to measure the performance capability of a repaired equipment. Equipment that is to be returned to stock should meet the standards given in these tests. Signal Generator AN/URM–49, AN/URM–49A, AN/URM–49B, or AN/URM–49C will be referred to as signal generator throughout the remainder of this section.

2. Applicable References

a. Repair Standards. Applicable procedures of the signal corps depot performing this test and its general standards for repaired signal equipment form a part of the requirements for testing this equipment.

b. Modification Work Orders. Perform all modification work orders applicable to this equipment before making the tests specified. DA Pam 310–4 lists all available MWO's.

3. Test Facilities Required

The following test items are required for depot testing:

Item	Technical manual	Common name
Pulse Generator SG–69A/PPM–1	----------	Pulse generator
Oscilloscope, Tektronix 515	----------	Oscilloscope
Microwave Power Meter ME–128/MSM–19	TM 9–9509–2–6–45	Power meter
Crystal Detector HP–420	----------	Crystal detector
Audio Oscillator TS–382/U	TM 11–2684	Audio oscillator
Transfer Oscillator HP–540A	----------	Transfer oscillator
Frequency Counter HP–524B	----------	Frequency counter
Frequency Converter HP–525B	----------	Frequency converter

4. General Test Requirements

Perform the tests under the conditions given below.

a. The source power should be 115 volts ac, 50 to 1,600 cycles per second.

b. Allow 1 hour for all equipment to reach stabilized temperatures.

c. Set the front-panel controls as follows:

Control	Position
HEATER-POWER switch	POWER
SIGNAL FREQUENCY MC dial	400 mc to 1,000 mc
MODULATION SELECTOR switch.	CW

d. Pulse delay measurements are to be made between start of sync pulse and 50 percent amplitude of radiofrequency (rf) pulse.

e. Pulse width measurements should be made at the 50-percent point of maximum amplitude.

f. Pulse rise and pulse decay measurements should be made at the 10- and 90-percent points of maximum amplitude.

5. SIGNAL FREQUENCY MC Dial Accuracy Test

a. Set the controls on the signal generator as follows:

(1) ZERO SET for a zero set indication on the POWER SET meter.
(2) RF switch to ON.
(3) MODULATION SELECTOR switch to CW.
(4) PWR SET control to 0 dbm on the POWER SET meter.
(5) OUTPUT ATTENUATOR for a suitable output.
(6) Other controls and switches in any position.

b. Connect the RF OUTPUT of the signal generator through the transfer oscillator to the frequency counter.

c. Check the SIGNAL FREQUENCY MC dial accuracy at 400 mc, 700 mc, and 1,000 mc.

d. The SIGNAL FREQUENCY dial accuracy should be ±1 percent over the entire frequency range.

6. OUTPUT ATTENUATOR Test

a. Adjust the controls as for the SIGNAL FREQUENCY dial accuracy test (par. 5).

b. Set the OUTPUT ATTENUATOR for —7 decibels (db) output.

c. Connect the RF OUTPUT to the power meter.

d. Check the power output at 400 mc, 700 mc, and 1,000 mc.

e. Power output should be −7 db ±2 as indicated on the power meter.

f. The calibrations refer to continuous wave (cw) or peak pulse power or peak pulse voltage into a 50-ohm load.

7. Pulse Modulation Test

a. Set the MODULATION SELECTOR switch to PULSE.

b. Connect the SYNC OUT of the signal generator to the frequency counter.

c. The pulse rate should meet the following figures:

SYNC SELECTOR switch	PULSE RATE control	RATE	
		Greater than	Less than
X1	Fully counterclockwise	----------	50
X1	Fully clockwise	300	
X10	Fully counterclockwise	----------	500
X10	Fully clockwise	3,000	
X1	40	30	50
X1	100	75	125
X1	400	300	500
X10	40	300	500
X10	100	750	1,250
X10	400	3,000	5,000

8. Pulse Width Test

a. Set the controls of the signal generator as follows:

(1) MODULATION SELECTOR switch to PULSE.
(2) PULSE DELAY control to 3.
(3) PULSE RATE control to 400.

b. Connect the RF OUTPUT of the signal generator, through the crystal detector, to the input of the oscilloscope.

c. Connect the DELAYED SYNC OUT jack from the signal generator to the sync input of the oscilloscope.

d. The pulse viewed on the oscilloscope should have the following characteristics:

(1) A risetime of 0.5 μsec or less.

(2) A decay time of 0.5 μsec or less.

(3) The pulse width should be as indicated with the PULSE WIDTH control set as follows:

PULSE WIDTH control setting	Pulse width	
	Greater than (μsec)	Less than (μsec)
Fully counterclockwise	----------	0.85
2	1.5	2.5
6	4.5	7.5
10	7.5	12.5
Fully clockwise	10.0	

9. Delayed Pulse Test

a. Connect the equipment as for the pulse width test (par. 8).

b. Set the PULSE WIDTH control to 4.

c. Note the position of the leading edge of the pulse on the oscilloscope sweep.

d. The pulse delay should be as indicated for the pulse delay settings listed below—

PULSE DELAY setting (μsec)	Pulse delay (μsec)
3	3 ±1.5
50	50 ±12.5
100	100 ±25.0
300	300 ±75.0

10. External Pulse Modulation Test

a. Connect the equipment as for the delayed pulse test (par. 9).

b. Set the MODULATION SELECTOR switch to POS.

c. Connect the pulse generator output to the EXT MOD jack on the signal generator.

d. Adjust the pulse generator output for a positive pulse output of 400 pulses per second (pps).

e. The pulse should appear on the oscilloscope with a minimum pulse generator output of 40 volts.

f. Change the MODULATION SELECTOR switch on the signal generator to NEG. There should be no pulse indication on the oscilloscope.

g. Change the pulse generator output to a negative pulse. The pulse output should appear on the oscilloscope.

11. Amplitude Modulation Test

a. Connect the equipment as for the external pulse modulation test (par. 10).

b. Connect the audio oscillator to the signal generator EXT MOD jack. Adjust the frequency to 400 cycles per second.

c. Set the MODULATION SELECTOR switch to AM.

d. With a minimum audio oscillator output of 3 volts, the power meter should indicate an increase of 0.191 db and a sine wave pattern should be indicated on the oscilloscope.

12. External Sync Modulation Test

a. Connect the pulse generator to the SYNC IN jack.

b. Connect the SYNC OUT jack to the oscilloscope sync.

c. Connect the RF OUTPUT to the oscilloscope input.

d. Set the MODULATION SELECTOR switch to PULSE.

e. Set the SYNC SELECTOR switch to POS.

f. Adjust the pulse generator output for a negative pulse, 10 volts minimum.

g. The pulse output should be indicated on the oscilloscope.

h. Connect the audio oscillator to the SYNC IN jack.

i. Set the SYNC SELECTOR switch to the SINE position.

j. Adjust the audio oscillator output for a minimum of 10 volts at 400 cps.

k. A pulse output should appear on the oscilloscope.

Appendix I, REFERENCES (page 3 of C 1).

Add the following above the first reference:

TM 9–9509–2–6–45 Ordnance Maintenance, Electrical Meter Assembly ME–128MSM–19 (Standing Wave Indicator HP415B and Microwave Power Meter HP430C).

TM 11–2684 Audio Oscillators TS–312/FSM–1, TS–312A/FSM–1, and

TS–382/U and Signal Generator TS–312B/FSM–1.

DA Pam 310–4 Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.

TM 9–213 Painting Instructions for Field Use.

TM 38–750 The Army Equipment Records Systems and Procedures.

By Order of the Secretary of the Army:

EARLE G. WHEELER,
General, United States Army,
Chief of Staff.

Official:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

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USA Corps (3)
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USAMICOM (4)
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DLSC (1)
Units original under following TOE:
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11–587
11–592
11–597

NG: State AG (3).

USAR: None.

For explanation of abbreviations used, see AR 320–50.

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35456 TECHNICAL DATA

TECHNICAL MANUAL

Organizational, Field and Depot Maintenance Manual

SIGNAL GENERATORS, AN/URM-49, AN/URM-49A, AN/URM-49B, AND AN/URM-49C

TM 11-6625-280-15
CHANGES No. 4

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., *26 October 1962*

TM 11-6625-280-15, 4 August 1959, is changed as follows:

Note. The parenthetical reference to previous Changes (example: "page 7 of C 2") indicates that pertinent material was published in those Changes.

Page 8-46 (page 7 of C 2, as changed by C 3, 12 January 1962).

Column 2, Change Federal Stock Number 6625-668-5426 to 6625-669-5131.

Page 8-46 (page 7 of C 2). Change as follows:

Column 2. Change Federal Stock Number 6625-545-7933 to 5995-753-2081.

Page 8-46 (page 7 of C 2). Change as follows:

Column 2. Reference Federal Stock Number 6625-502-6077.

Column 4. Change to read: CABLE ASSEMBLY, POWER ELECTRICAL CX-337/U.

Page 8-46 (page 7 of C 2). Change as follows:

Column 2. Change Federal Stock Number 6625-184-4366 to 5995-823-2588.

Column 4. Change to read: CABLE ASSEMBLY, POWER ELECTRICAL CX-3135/U (8'0).

Page 8-46 (page 7 of C 2). Change as follows:

Column 2. Change Federal Stock Number 5935-701-3090 to 5935-258-7429.

Page 8-46 (page 7 of C 2). Change as follows:

Column 2. Change Federal Stock Number 5935-149-3914 to 5935-823-0639.

* These changes supersede C 3, 12 January 1962.

By Order of the Secretary of the Army:

EARLE G. WHEELER,
General, United States Army,
Chief of Staff.

Official:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

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USASSAMRO (1)
USARCARIB Sig Agcy (1)
USA Sig Msl Spt Agcy (13)
Sig Fld Maint Shops (3)
Def Log Svc Cen (1)
Units org under fol TOE (2 cy ea UNOINDC)
11–7
11–16
11–57
11–97
11–98
11–117
11–155
11–157
11–500 (Tms AA–AE) (4)
11–557
11–587
11–592
11–597
32–57
32–78

NG: State AG (3).

USAR: None.

For explanation of abbreviations used, see AR 320–50.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1962—650505

TECHNICAL DATA

TECHNICAL MANUAL

Organizational, Field and Depot Maintenance Manual

SIGNAL GENERATORS, AN/URM–49, AN/URM–49A, AN/URM–49B AND AN/URM–49C

TM 11–6625–280–15
CHANGES No. 2

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *19 July 1961*

TM 11–6625–280–15, 4 August 1959, is changed as follows:

Page 8–46 (page 3, C1). Designate the present appendix: APPENDIX I.

Appendix I is changed as follows:

Delete all reference to TM 11–6625–280–10P.

Change TM 11–6625–280–20P to read:

TM 11–6625–280–20P, Organizational Maintenance Repair Parts and Special Tool Lists, Signal Generator AN/URM–49 and AN/URM–49A.

***These changes supersede TM 11–6625–280–10P, 1 June 1959, and so much of TM 11–6625–280–20P, 1 June 1959, as pertains to maintenance allocation chart, and so much of DA Supply Manual SIG 7 & 8 TS–418/U, 16 April 1960, as pertains to first echelon items.**

APPENDIX II (Added)
MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

1. General

a. The maintenance allocation chart assigns maintenance functions and repair operations to be performed by the lowest appropriate maintenance echelon.

b. Columns in the maintenance allocation chart are as follows:

(1) *Part or component.* This column shows only the nomenclature or standard item name. Additional descriptive data is included only where clarification is necessary to identify the part. Components and parts comprising a major end item are listed alphabetically. Assemblies and subassemblies are in alphabetical sequence with their components listed alphabetically immediately below the assembly listing.

(2) *Maintenance function.* This column indicates the various maintenance functions allocated to the echelon capable of performing the operations.

(*a*) *Service.* To clean, to preserve, and to replenish fuel and lubricants.

(*b*) *Adjust.* To regulate periodically to prevent malfunction.

(*c*) *Inspect.* To verify serviceability and to detect incipient electrical or mechanical failure by scrutiny.

(*d*) *Test.* To verify serviceability and to detect incipient electrical or mechanical failure by use of special equipment such as gages, meters, etc.

(*e*) *Replace.* To substitute service assemblies, subassemblies, and parts for unserviceable components.

(*f*) *Repair.* To restore an item to serviceable condition through correction of a specific failure or unserviceable condition. This function includes but is not limited to, inspecting, cleaning, preserving, adjusting, replacing, welding, riveting, and straightening.

(*g*) *Align.* To adjust two or more components of an electrical system so that their functions are properly synchronized.

(*h*) *Calibrate.* To determine, check, or rectify the graduation of an instrument, weapon, or weapons system, or components of a weapons system.

(*i*) *Rebuild.* To restore an item to a standard as near as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through the maintenance technique of complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements using original manufacturing tolerances and/or specifications and subsequent reassembly of the item.

(*j*) *Overhaul.* To restore an item to completely serviceable condition as prescribed by serviceability standards developed and published by heads of technical services. This is accomplished through employment of the technique of "Inspect and Repair Only as Necessary" (IROAN). Maximum utilization of diagnostic and test equipment is combined with minimum disassembly of the item during the overhaul process.

(3) *1st, 2d, 3d, 4th, 5th echelon.* The symbol X indicates the echelon responsible for performing that particular maintenance operation, but does not necessarily indicate that repair parts will be stocked at that level. Echelons higher than the echelon marked by X

are authorized to perform the indicated operation.

(4) *Tools required.* This column indicates codes assigned to each individual tool equipment, test equipment, and maintenance equipment referenced. The grouping of codes in this column of the maintenance allocation chart indicates the tool, test, and maintenance equipment required to perform the maintenance function.

(5) *Remarks.* Entries in this column will be utilized when necessary to clarify any of the data cited in the preceding columns.

c. Columns in the allocation of tools for maintenance functions are as follows:

(1) *Tools required for maintenance functions.* This column lists tools, test, and maintenance equipment required to perform the maintenance functions.

(2) *1st, 2d, 3d, 4th, 5th echelon.* The dagger (†) symbol indicates the echelons allocated the facility.

(3) *Tool code.* This column lists the tool code assigned.

2. Mounting Hardware

The basic entries of the maintenance allocation chart do not include mounting hardware such as screws, nuts, bolts, washers, brackets, clamps, etc.

3. Maintenance by Using Organizations

When this equipment is used by signal services organizations organic to theater headquarters or communication zones to provide theater communications, those maintenance functions allocated up to and including fourth echelon are authorized to the organization operating this equipment.

Section II. MAINTENANCE ALLOCATION CHART

(1) PART OR COMPONENT	(2) MAINTENANCE FUNCTION	(3) 1ST ECH	(4) 2ND ECH.	(5) 3RD ECH.	(6) 4TH ECH.	(7) 5TH ECH.	(8) TOOLS REQUIRED	(9) REMARKS
SIGNAL GENERATOR AN/URM-49; AN/URM-49A	service				X			
	adjust				X		2,3,4,5,10	
	inspect				X			
	test				X		1,2,3,4,5,6,7, 9,10	
	repair				X			
	calibrate					X	1,2,3,5,6,8, 10,11	
	rebuild					X		
CABLE ASSEMBLY, POWER ELECTRICAL	repair		X					
CABLE ASSEMBLIES, RADIO FREQUENCY	repair				X			
CASE, CY-741/U	replace					X		Fabricate
GENERATOR, SIGNAL: TS-418A,B,C/U	adjust				X		2,3,4,5,10	
	inspect				X			
	test				X		1 thru 7 9,10	
	repair				X			
	calibrate					X	1,2,3,5,6,8, 10,11	
	rebuild					X		
ATTENUATOR SUB-ASSEMBLY	inspect				X			
	replace				X			
OSCILLATOR SUB-ASSEMBLIES	inspect				X			
	replace				X			
SUB-ASSEMBLIES: I-203, 0217,0225	replace				X			

Section III. ALLOCATION OF TOOLS FOR MAINTENANCE FUNCTIONS

(1) TOOLS REQUIRED FOR MAINTENANCE FUNCTIONS	(2) 1ST ECH.	(3) 2ND ECH.	(4) 3RD ECH.	(5) 4TH ECH.	(6) 5TH ECH.	(7) TOOL CODE	(8) REMARKS
AN/URM-49; AN/URM-49A (continued)							
AUDIO OSCILLATOR TS-382/U				†	†	1	
ELECTRONIC MULTIMETER TS-505/U				†	†	2	
FREQUENCY METER TS-186/AP				†	†	3	
MULTIMETER AN/URM-105				†	†	4	
OSCILLOSCOPE AN/USM-50				†	†	5	
PULSE GENERATOR AN/UPM-15				†	†	6	
SHUNT, INSTRUMENT MULTIRANGE MX-1471/U				†	†	7	
TEST SET, ELECTRON TUBE TV-2/U					†	8	
TEST SET, ELECTRON TUBE TV-7/U				†		9	
TOOL EQUIPMENT TK-21/G				†	†	10	
WATTMETER AN/URM-98				†	†	11	

APPENDIX III
BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

1. Scope

a. This appendix lists items supplied for initial operation and for running spares. The list includes tools, accessories, parts, and material issued as part of the major end item. The list includes all items authorized for basic operator maintenance of the equipment. End items of equipment are issued on the basis of allowances prescribed in equipment authorization tables and other documents that are a basis for requisitioning.

b. Columns are as follows:

(1) *Source, maintenance, and recoverability code.* Not used.

(2) *Federal stock number.* This column lists the 11-digit Federal stock number.

(3) *Designation by model.* The dagger (†) indicates the model in which the part is used or procured.

(4) *Description.* Nomenclature or the standard item name and brief identifying data for each item are listed in this column. When requisitioning, enter the nomenclature and description.

(5) *Unit of issue.* The unit of issue is the supply term by which the individual item is counted for procurement, storage, requisitioning, allowances, and issue purposes.

(6) *Expendability.* Nonexpendable items are indicated by NX.

(7) *Quantity authorized.* Under "Items Comprising an Operable Equipment", the column lists the quantity of items supplied for the initial operation of the equipment. Under "Running Spares and Accessory Items", the quantities listed are those issued initially with the equipment as spare parts. The quantities are authorized to be kept on hand by the operator for maintenance of the equipment.

(8) *Illustration.* The "Item No." column lists the reference symbols used for identification of the items in the illustration or text of the manual.

2. Comments or Suggestions

Any comments concerning omissions and discrepancies in appendix II and appendix III will be prepared on DA Form 2028 and forwarded direct to Commanding Officer, U.S. Army Signal Materiel Support Agency, ATTN: SIGMS-ML, Fort Monmouth, N.J.

Section II. FUNCTIONAL PARTS LIST

(1) SOURCE MAINTENANCE AND RECOVERABILITY CODE	(2) FEDERAL STOCK NUMBER	(3) DESIGNATION BY MODEL	(4) DESCRIPTION	(5) UNIT OF ISSUE	(6) EXPENDABILITY	(7) QUANTITY AUTHORIZED	(8) ILLUSTRATIONS FIGURE NO	(9) ILLUSTRATIONS ITEM NO
	6625-668-5426	1 2 3	SIGNAL GENERATOR AN/URM-49, AN/URM-49A: Provides RF signals at any desired frequency within a range of 400 to 1600 megacycles per second, and any desired level within the range of 0.2 microvolt to 200,000 microvolts when loaded with its rated load of 50 ohms resistance					
			NOTE: Model Column 1 refers to AN/URM-49, Order No. 185 PH-51, (TS-418B/U); Column 2 refers to AN/URM-49, Order No. R-53-0418-SC-91, (TS-418B/U); Column 3 refers to AN/URM-49A, (TS-418C/U)					
			ITEMS COMPRISING AN OPERABLE EQUIPMENT					
	Ord thru AGC	† † †	TECHNICAL MANUAL TM 11-6625-280-B11L			2		
	Ord thru AGC	† † †	TECHNICAL MANUAL TM 11-6625-280-15			2		
	6625-515-7933	† † †	CABLE ASSEMBLY, RADIO FREQUENCY CG-546/U (6 ft)			1		
	6625-660-9321	† † †	CABLE ASSEMBLY, RADIO FREQUENCY CG-546A/U (8 ft)			2		
	6625-502-6077	† †	CABLE ASSEMBLY, RADIO FREQUENCY CX337/U			1		
	6-25-181-1366	†	CABLE ASSEMBLY, POWER, ELECTRICAL CX-3277/U			1		
	6-25-669-0333	† † †	CASE, TEST SET CY-711/U			1		
	5935-701-3090	† † †	CONNECTOR, ADAPTER, ELECTRICAL UG-201A/U			3		E108 E209 E210
	5935-149-3914	† † †	CONNECTOR, ADAPTER, ELECTRICAL UG-255/U			3		E211 E212 E213
	5935-149-3534	† † †	CONNECTOR, ADAPTER, ELECTRICAL UG-273/U			3		E205 thru E207

(1) SOURCE MAINTENANCE AND RECOVERABILITY CODE	(2) FEDERAL STOCK NUMBER	(3) DESIGNATION BY MODEL	(4) DESCRIPTION	(5) UNIT OF ISSUE	(6) EXPENDABILITY	(7) QUANTITY AUTHORIZED	(8) ILLUSTRATIONS FIGURE NO	(9) ILLUSTRATIONS ITEM NO
		1 2 3	AN/URM-49, AN/URM-49A (continued)					
	6625-405-7692	† † †	GENERATOR, SIGNAL TS-418B/U; TS-418C/U		NX	1		
	5120-392-8380	†	WRENCH, SPANNER: 1 9/16 in wd opening; Lavoie No. 1410155			1		
	5120-596-1362	†	WRENCH, SPANNER, PIN: Transitron No. A-109-00276			1		
			RUNNING SPARES AND ACCESSORY ITEMS					
			SIGNAL GENERATOR AN/URM-49, AN/URM-49A					
			GENERATOR SIGNAL. TS-418B/U; TS-418C/U					
	5960-262-3763	† † †	ELECTRON TUBE: JAN type 0B2WA			1		V106 V107
	5960-188-3945	† † †	ELECTRON TUBE: JANtype 5R4WGA			1		V102
	5960-262-0218	† † †	ELECTRON TUBE: JAN type 5Y3WGTA			1		V101
	5960-188-8565	† † †	ELECTRON TUBE: JAN type 6AG7Y			1		V104
	5960-188-3545	† † †	ELECTRON TUBE: JAN type 6AK5			1		V105
	5960-188-3967	† † †	ELECTRON TUBE: JAN type 6J6			1		V103 V305 V307
	5960-262-0167	† † †	ELECTRON TUBE: JAN type 12AT7WA			1		V302 V304
	5960-166-7664	† † †	ELECTRON TUBE: JAN type 12AX7			1		V301
	5920-010-6652	† † †	FUSE, CARTRIDGE: MIL type F02G3R00A			5		F101 F102
	6240-057-2887	† † †	LAMP, INCANDESCENT: GE No. 44			3		E107
	6240-155-8706	† † †	LAMP, INCANDESCENT: GE No. 47			3		E108

BY ORDER OF THE SECRETARY OF THE ARMY:

G. H. DECKER,
General, United States Army,
Chief of Staff.

Official:

R. V. LEE,
Major General, United States Army,
The Adjutant General.

Distribution:

Active Army:

DASA (5)
USASA (2)
CNGB (1)
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CSigO (18)
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USCONARC (5)
USAARTYBD (1)
USAARMBD (2)
USAIB (1)
USARADBD (2)
USAABELCTBD (1)
USAAVNBD (1)
USAATBD (1)
ARADCOM (2)
ARADCOM Rgn (2)
OS Maj Comd (3)
OS Base Comd (2)
LOGCOMD (2)
MDW (1)
Armies (2)
Corps (5)
USATC Armor (2)
USATC Engr (2)
USATC FA (2)
USATC Inf (2)
USATC AD (2)
Svc Colleges (2)
Br Svc Sch (2)
GENDEP (2) except
Atlanta GENDEP (none)
Sig Sec, GENDEP (5)
Sig Dep (12)
Ft Monmouth (63)
AFIP (1)
WRAMC (1)
Yuma Test Sta (2)
USAEPG (2)
EMC (1)
USACA (3)
USASEA (1)
USA Caribbean Sig Agcy (1)
USA Sig Msl Spt Agcy (13)
USASSA (20)
USASSAMRO (1)
Army Pictorial Cen (2)
USAOMC (3)
USA Trans Tml Comd (1)
Army Tml (1)
POE (OS) (1)
OSA (1)
AMS (1)
Sig Fld Maint Shops (3)
JBUSMC (2)
Units org under fol TOE:
11–7 (2)
11–16 (2)
11–57 (2)
11–98 (2)
11–117 (2)
11–155 (2)
11–500 (AA–AE) (4)
11–557 (2)
11–587 (2)
11–592 (2)
11–597 (2)

NG: None.

USAR: None.

For explanation of abbreviations used, see AR 320–50.

TECHNICAL MANUAL

Organizational, Field and Depot Maintenance Manual

SIGNAL GENERATORS AN/URM–49, AN/URM–49A, AN/URM–49B, AND AN/URM–49C

TM 11–6625–280–15
CHANGES No. 1

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *2 August 1960*

TM 11–6625–280–15, 4 August 1959, is changed as follows:

TM 11–6625–280–15 is changed as indicated so that the manual also applies to Signal Generator TS–418C/U.

The title is changed as shown above.

Add "TS–418C/U" after "TS–418B/U" in the following places:

Page 1–1, paragraph 1*a,* line 3.
Paragraph 1*b,* lines 2 and 12.

Add "(On Signal Generator TS–418C/U, 394 to 1,000 megacycles per second)" after "per second" in the following places:

Page 1–1, paragraph 2, line 9.

Page 1–2, paragraph 5, line 3.

Add "(On Signal Generator TS–418C/U, 394 to 1,000 megacycles)" after "megacycles" in the following places:

Page 2–0, paragraph 1, line 3.

Page 2–1, paragraph 2*b,* line 4.

Add "Signal Generators TS–418B/U and TS–418C/U" after the caption in the following figures:

Page 8–5, figure 8–3.

Page 8–6, figures 8–5, and 8–6.

Page 8–7, figures 8–7, and 8–8.

Page 8–8, figures 8–9, and 8–10.

Add "TS–418C/U" after "TS–418B/U" in the following figure captions:

Page 8–5, figure 8–4.

Page 8–11/8–12, figure 8–12.

Page 8–13/8–14, figure 8–13.

Page 8–15/8–16, figure 8–14.

Page 1–1, paragraph 1. Make the following changes:

Add the following note below the title:

Note. AN/URM–49 is the overall nomenclature for Signal Generators TS–418/U, TS–418A/U, TS–418B/U, and TS–418C/U.

Subparagraph *b,* line 3. Change "both" to: all.

Page 1–4, paragraph 8. Add subparagraph *c.*1 after subparagraph *c*:

*c.*1. On Signal Generator TS–418C/U, Cable Assembly, Power Electrical CX–3277/U (6′0″) is provided for connecting the plug on the instrument to the ac supply. The cord consists of approximately 6 feet of three-conductor cable with a conventional male power plug (Hubbel 7057) on one end and a female plug (Amphenol 10SL–35) on the other.

Page 2–4, paragraph 3. Make the following changes:

Add the following note after subparagraph *b*(3):

Note. On Signal Generator TS–418C/U, if it is not possible to do this, set the ZERO SET control approximately to the middle of its rotation and after unscrewing the plug, adjust the COARSE ZERO SET control to bring meter to index line. The COARSE ZERO SET control does not need readjustment unless large excursions of ambient temperature are encountered. Replace the plug tightly after any adjustment of the COARSE ZERO SET control.

Add the following note after subparagraph *f*(1):

Note. On Signal Generator TS–418C/U, with the modulating signal disconnected, follow the procedures in *b*(3) and (4) above, but with control 6 set to AM.

Page 3–0, paragraph 2, line 10. After "figure 7–1," add: (fig. 7–1.1 for TS–418C/U).

Page 3–3, paragraph 3*b,* note right-hand column, line 1. After "The" add: TS–418/U

and TS–418A/U. Paragraph 4*a*. After the first sentence, add: On Signal Generator TS–418C/U, the modulator section includes tubes V301 (12AX7); V302, V304 (12AT7); V303, V305 (6J6); V306 (6AG7); and V307 (6J6).

Page 3–5, paragraph 4*b*(1), note, line 6. Delete "factory."

Page 3–6, paragraph 4*b*(4). Make the following changes:

Line 9. After "figure 7–2," add: (fig. 8–12 for TS–418C/U).

Line 14. After "and 3–9," add: (fig. 8–5, 8–6, and 8–7, for TS–418C/U).

Paragraph 4*c*, line 2. After "figure 3–10," add: (fig. 8–8 for TS–418C/U).

Page 3–7, paragraph 4. Make the following changes:

After the second paragraph, add: On Signal Generator TS–418C/U, potentiometer R369 (fig. 8–2), delay stability, is adjusted to give the correct bias for V303. If the bias is too low, the delay circuit will free-run. If the bias is too high, the circuit will act as an amplifier rather than a multivibrator near minimum delay, resulting in approximately a 1-microsecond jump in delay as the delay control is varied.

Add subparagraph *e*.1 after subparagraph *e:*

e.1. Sync Out Circuits on Signal Generator TS–418C/U. In addition to the output pulse for the delay multivibrator, a parallel output is taken from the plate of series diode limiter V302B to produce a positive video SYNC OUT pulse. The negative pulse from V302B is coupled to inverting amplifier V304A (12AT7). Coupling capacitor C322 is of small capacitance (24 micromicrofarads) to minimize loading effects on the delay multivibrator. The sharpened leading edge of the positive output pulse from V304A is applied as a trigger to blocking oscillator V304B. This tube, normally biased beyond cutoff (about 16 volts negative) by voltage divider R324 and R323, generates a sharp positive pulse which is taken across cathode resistor R236 and applied as the SYNC OUT pulse to output terminal J303. This pulse has an amplitude about 65 volts without external load and 45 volts when the rated load of 500 ohms shunted by 1,500 micromicrofarads is used. Figure 8–9 shows that the leading edge of the SYNC OUT pulse is essentially coincident with that of the original externally applied SYNC IN pulse, occurring at time t_1. The positive delay pulse is also used to trigger the pulse width multivibrator at time t_2, that is, a time coincident with the trailing edge of the delay pulse. After the positive delay pulse is differentiated in the coupling network, capacitor C315 and resistors R334 and R335 (fig. 5–3, mounted on the bracket that holds R335), a positive trigger coincident with the leading edge of the delay pulse is applied to the grid of V306 (6AG7) in the pulse width multivibrator circuit. Because V306 is normally conducting, it is triggered only by the negative pulse and unaffected by the positive pulse.

Page 3–10, paragraph 4. Add subparagraph *i*.1 after subparagraph *i:*

i.1. On Signal Generator TS–418C/U, the presence of R370 on am. drops the plate voltage of V201 (2C36) to a lower value than used on cw and permits greater percentages of modulation without distortion at the higher oscillator frequencies. Lower plate voltage at V201 will result in a decrease in power output; therefore, it is necessary to perform zero and power setting functions on am. before applying modulation to the EXT MOD jack.

Page 3–11, paragraph 6. Make the following changes:

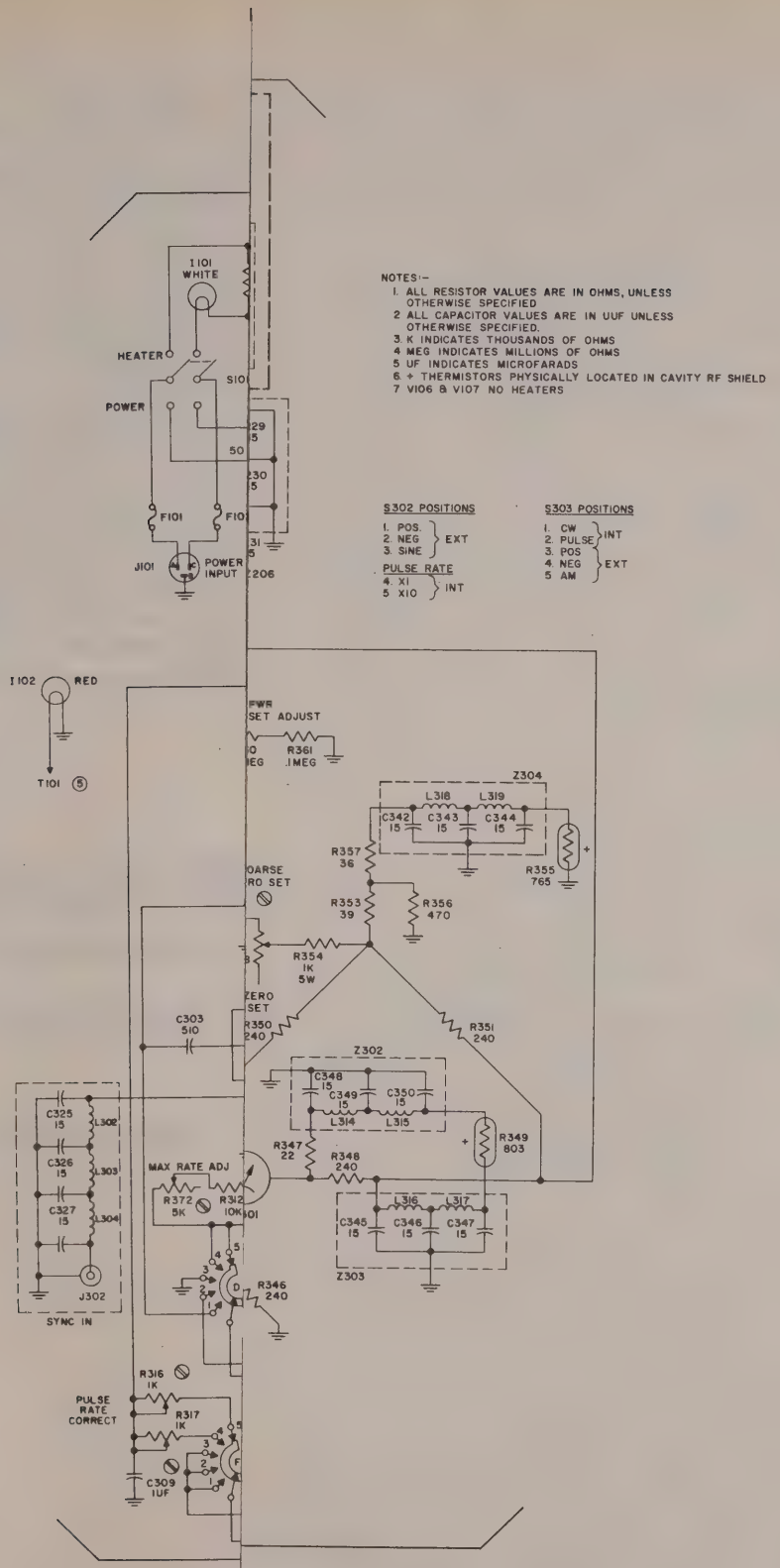
Second subparagraph, line 4. After "figure 7–1," add: (fig. 8–19 on TS–418C/U).

Last line. After the last sentence, add: The normal setting for R360 is that which places 175 volts on the plate of V201 when the MOD SELECTOR switch is on CW.

Fourth subparagraph, line 1. After "(5R4GY)," add: (V101 (5Y3GT) in TS–418C/U).

Page 4–6, paragraph 7*b*(1). Add the following note after subparagraph (*i*).

Note. On Signal Generator TS–418C/U, use MAX RATE ADJ variable resistor R372 in conjunction with pulse rate adjustments R313, R316, and R317 when calibrating PULSE RATE dial 1303 or making a pulse rate adjustment. Follow the given procedure and adjust variable resistor R372 to balance any adjustment made to R313.



NOTES:-
1. ALL RESISTOR VALUES ARE IN OHMS, UNLESS OTHERWISE SPECIFIED
2. ALL CAPACITOR VALUES ARE IN UUF UNLESS OTHERWISE SPECIFIED.
3. K INDICATES THOUSANDS OF OHMS
4. MEG INDICATES MILLIONS OF OHMS
5. UF INDICATES MICROFARADS
6. + THERMISTORS PHYSICALLY LOCATED IN CAVITY RF SHIELD
7. V106 & V107 NO HEATERS

S302 POSITIONS
1. POS. } EXT
2. NEG
3. SINE
PULSE RATE
4. X1 } INT
5. X10

S303 POSITIONS
1. CW } INT
2. PULSE
3. POS } EXT
4. NEG
5. AM

and TS–418A/U. Paragraph 4*a*. After the first sentence, add: On Signal Generator TS–418C/U, the modulator section includes tubes V301 (12AX7); V302, V304 (12AT7); V303, V305 (6J6); V306 (6AG7); and V307 (6J6).

Page 3–5, paragraph 4*b*(1), note, line 6. Delete "factory."

Page 3–6, paragraph 4*b*(4). Make the following changes:

Line 9. After "figure 7–2," add: (fig. 8–12 for TS–418C/U).

Line 14. After "and 3–9," add: (fig. 8–5, 8–6, and 8–7, for TS–418C/U).

Paragraph 4*c*, line 2. After "figure 3–10," add: (fig. 8–8 for TS–418C/U).

Page 3–7, paragraph 4. Make the following changes:

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Add subparagraph *e*.1 after subparagraph *e*:

e.1. *Sync Out Circuits on Signal Generator TS–418C/U.* In addition to the output pulse for the delay multivibrator, a parallel output is taken from the plate of series diode limiter V302B to produce a positive video SYNC OUT pulse. The negative pulse from V302B is coupled to inverting amplifier V304A (12AT7). Coupling capacitor C322 is of small capacitance (24 micromicrofarads) to minimize loading effects on the delay multivibrator. The sharpened leading edge of the positive output pulse from V304A is applied as a trigger to blocking oscillator V304B. This tube, normally biased beyond cutoff (about 16 volts negative) by voltage divider R324 and R323, generates a sharp positive pulse which is taken across cathode resistor R236 and applied as the SYNC OUT pulse to output terminal J303. This pulse has an amplitude about 65 volts without external load and 45 volts when the rated load of 500 ohms shunted by 1,500 micromicrofarads is used. Figure 8–9 shows that the leading edge of the SYNC OUT pulse is essentially coincident with that of the original externally applied SYNC IN pulse, occurring at time t_1. The positive delay pulse is also used to trigger the pulse width multivibrator at time t_2, that is, a time coincident with the trailing edge of the delay pulse. After the positive delay pulse is differentiated in the coupling network, capacitor C315 and resistors R334 and R335 (fig. 5–3, mounted on the bracket that holds R335), a positive trigger coincident with the leading edge of the delay pulse is applied to the grid of V306 (6AG7) in the pulse width multivibrator circuit. Because V306 is normally conducting, it is triggered only by the negative pulse and unaffected by the positive pulse.

Page 3–10, paragraph 4. Add subparagraph *i*.1 after subparagraph *i*:

i.1. On Signal Generator TS–418C/U, the presence of R370 on am. drops the plate voltage of V201 (2C36) to a lower value than used on cw and permits greater percentages of modulation without distortion at the higher oscillator frequencies. Lower plate voltage at V201 will result in a decrease in power output; therefore, it is necessary to perform zero and power setting functions on am. before applying modulation to the EXT MOD jack.

Page 3–11, paragraph 6. Make the following changes:

Second subparagraph, line 4. After "figure 7–1," add: (fig. 8–19 on TS–418C/U).

Last line. After the last sentence, add: The normal setting for R360 is that which places 175 volts on the plate of V201 when the MOD SELECTOR switch is on CW.

Fourth subparagraph, line 1. After "(5R4GY)," add: (V101 (5Y3GT) in TS–418C/U).

Page 4–6, paragraph 7*b*(1). Add the following note after subparagraph (*i*).

Note. On Signal Generator TS–418C/U, use MAX RATE ADJ variable resistor R372 in conjunction with pulse rate adjustments R313, R316, and R317 when calibrating PULSE RATE dial 1303 or making a pulse rate adjustment. Follow the given procedure and adjust variable resistor R372 to balance any adjustment made to R313.

POWER SUPPLY

RF SECTION

CAVITY RF SHIELD

MODULATOR SECTION

NOTES:-
1 ALL RESISTOR VALUES ARE IN OHMS, UNLESS OTHERWISE SPECIFIED
2 ALL CAPACITOR VALUES ARE IN UUF UNLESS OTHERWISE SPECIFIED
3 K INDICATES THOUSANDS OF OHMS
4 MEG INDICATES MILLIONS OF OHMS
5 UF INDICATES MICROFARADS
6 ✣ THERMISTORS PHYSICALLY LOCATED IN CAVITY RF SHIELD
7 V106 & V107 NO HEATERS

S302 POSITIONS
1 POS, 2 NEG } EXT
3 SINE
PULSE RATE
4 XI, 5 X10 } INT

S303 POSITIONS
1 CW } INT
2 PULSE, 3 POS, 4 NEG } EXT
5 AM

HEATER AND CORRESPONDING T-101 TERMINALS

TM6625-280-15-CI-1

Figure 7–1.1. Signal Generator TS–418C/U, schematic diagram.

Page 4–21, paragraph 9*b*(2). After the fourth subparagraph, add:

On Signal Generator TS–418C/U, to set dial cam stops O–215 and O–216 (fig. 4–28), rotate dial I203 to O.010. Dial stop cam O215 should now push down on dial stop arm O208 (figs. 4–28 and 4–25), forcing it through cavity support block A203. When the pin projects above cam O216, blocking further movement upward of this cam and of the dials clockwise, tighten setscrew H229 to lock cam O216 in this position. Slowly rotate dial I203 in the opposite direction to the high end of the frequency band while observing the movement of cam O216 to be sure it clears the dial stop pin projecting through cavity support block A203. If cam O216 should catch on the dial stop pin while rotating dial I202 towards the high end of the frequency band, repeat adjustment procedure and slightly offset the toe cam until it passes the dial stop pin when rotating dial I203 from the low end of the frequency band to the high end. Set the signal frequency to the high end of the band. Cam O215 should now push up against dial stop arm O208, with cam O216 pushing down on the dial stop pin. It may be necessary to check several trial positions before the best setting of the cams is achieved.

Page 6–1. Delete paragraphs 1 through 5.

Page 6–3. Delete table 6–1.

Page 6–9. Delete table 6–1.

Page 7–3/7–4. Add figure 7–1.1 after figure 7–1.

Page 8–4. Delete table 8–1.

Page 8–20. Delete table 6–1.

Page 8–46. Add the following:

APPENDIX

REFERENCES

Following is a list of references applicable and available to the operator of Signal Generators TS–418/U, TS–418A/U, TS–418B/U, and TS–418C/U:

TM 11–6625–280–10P	Operator's Maintenance Repair Parts and Special Tools List for Signal Generator AN/URM–49, AN/URM–49A.
TM 11–6625–280–20P	Organizational Maintenance Repair Parts and Special Tools List and Maintenance Allocation Chart: Signal Generator AN/URM–49, AN/URM–49A.
TM 11–6625–280–35P	Field and Depot Maintenance Repair Parts and Special Tools List: Signal Generator AN/URM–49, AN/URM–49A.

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NG: None.

USAR: None.

For explanation of abbreviations used, see AR 320–50.

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UNSATISFACTORY REPORT

For U. S. Air Force Personnel:

In the event of malfunctioning, unsatisfactory design, or unsatisfactory installation of any of the component units of this equipment, or if the material contained in this book is considered inadequate or erroneous, an Unsatisfactory Report, USAF Form No. 54, or a report in similar form, shall be submitted in accordance with the provisions of U.S. Air Force Regulation No. 15-54, listing:

1. Station and organization.
2. Nameplate data (type number or complete nomenclature if nameplate is not attached to the equipment).
3. Date and nature of failure.
4. Radio model and serial number.
5. Remedy used or proposed to prevent recurrence.
6. Handbook errors or inadequacies, if applicable.

For U. S. Navy Personnel:

Report of failure of any part of this equipment shall be made on Form NAVAER-4112, "Report of Unsatisfactory or Defective Material," or a report in similar form, and forwarded in accordance with the latest instructions of the Bureau of Aeronautics. Such reports of failure shall include:

1. Reporting activity.
2. Nameplate data.
3. Date placed in service.
4. Part which failed.
5. Nature and cause of failure.
6. Remedy used or proposed to prevent recurrence.

CONTRACTUAL GUARANTEE

The Contractor guarantees that at the time of delivery thereof the articles provided for under this contract will be free from any defects in material or workmanship and will conform to the requirements of this contract. Notice of any such defect or nonconformance shall be given by the Government to the Contractor within one (1) year of the delivery of the defective or nonconforming article. If required by the Government within a reasonable time after such notice, the Contractor shall with all possible speed correct or replace the defective or non conforming article or part thereof. When such correction or replacement requires transportation of the article or part thereof, shipping costs, not exceeding usual charges, from the delivery point to the Contractor's plant and return, shall be borne by the Contractor; the Government shall bear all other shipping costs. This guaranty shall then continue as to corrected or replacing articles, or, if only parts of such articles are corrected or replaced, to such corrected or replacing parts, until one (1) year after the date of redelivery. If the Government does not require correction or replacement of a defective or nonconforming article, the Contractor, if required by the contracting officer within a reasonable time after the notice of defect or nonconformance, shall repay such portion of the contract price of the article as is equitable in the circumstances.

WARNING

This equipment employs high voltages (600 volts) which are dangerous to life. Operating personnel must at all times observe all safety regulations. Do not change tubes or make adjustments inside the equipment unless the power cord is disconnected. Although bleeder circuits are used to prevent capacitors from retaining charges after the power has been disconnected, always discharge and ground circuits before touching them in order to avoid casualties.

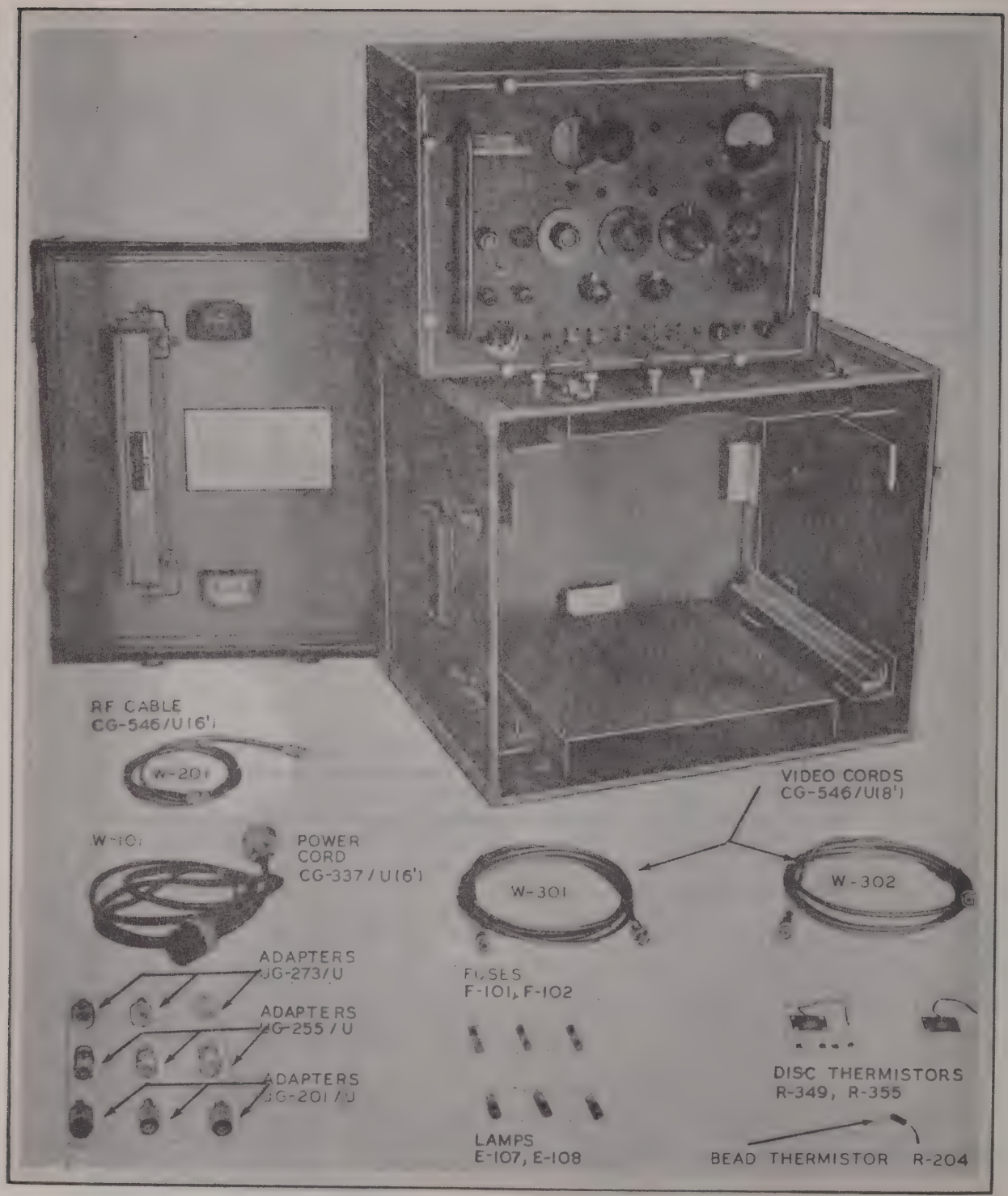


Figure 1-1. Signal Generator TS-418/U, Equipmemt Supplied

SECTION 1

GENERAL DESCRIPTION

1. PURPOSE OF HANDBOOK.

a. The purpose of this handbook is to describe the operation, adjustment, and maintenance of Signal Generators TS-418/U, TS-418A/U and TS-418B/U.

b. Since Signal Generators TS-418/U, TS-418A/U and TS-418B/U have the same function, the text is written to apply equally to both equipments, with reference made only to the TS-418/U. Where specific differences exist between TS-418/U and TS-418A/U equipments, reference is made to the specific signal generator under discussion and the TS-418B/U differences are stated in the Difference Data Sheets, Section VIII. Throughout this handbook illustrations have been included wherever necessary to indicate the differences between Signal Generators TS-418/U, TS-418A/U and TS-418B/U.

2. PURPOSE OF EQUIPMENT.

Signal Generator TS-418/U is a portable, self-contained test equipment designed for use with radio and radar receivers and for other applications requiring small amounts of RF power, such as the measuring of standing wave ratios, antenna characteristics, transmission line characteristics, conversion gain, etc. The instrument provides RF signals at any desired frequency within the range of 400 to 1000 megacycles per second, and at any desired level within the range of 0.2 microvolt to 200,000 microvolts when loaded with its rated load of 50 ohms resistance. Both the desired frequency and level of the RF signal are selected and directly indicated by means of calibrated front panel controls.

3. EQUIPMENT SUPPLIED.

The equipment supplied with Signal Generator TS-418/U is shown in figure 1-1 and listed in table 1-1. The weight shown for the equipment itself does not include the weights of the accessories. Also, two additional spare fuses are located in the spare fuseholders on the front panel of Signal Generator TS-418/U; these two fuses are not listed in the table.

TABLE 1-1. EQUIPMENT SUPPLIED

Quan. per Equipment	Name of Unit	Army-Navy Type Designation	Overall Dimensions (Inches)			Weight (Pounds) (per unit)	Number Series of Reference Symbol
			Length or Depth	Width	Height		
1	Signal Generator	TS-418/U	17 5/8	13 1/2	12 3/8	54 1/2	101-399
1	Signal Generator	TS-418A/U	17 3/8	13 1/2	12 3/8	63.2	101-399
1	Transit Case	CY-741/U	21 7/8	18 5/8	16	24	
1	Power Cord	CX-337/U(6')	72			0.6	W-101
1	RF Cable	CG-546/U(6'0")	72			0.3	W-203
2	Video Cord	CG-546/U(8'0")	96			0.4	W-301, W-302
3	Adapter	UG-201/U	1 9/16 x 3/4 OD			0.1	E-208 E-209 E-210
3	Adapter	UG-255/U	1 3/8 x 5/8			0.1	E-211 E-212 E-213
3	Adapter	UG-273/U				0.1	E-205 E-206 E-207
2	Fuse		1 1/4 x 1/4 OD				F-305, F-306, F-307
3	Pilot Lamp		1 1/8 x 3/8 OD				E-326, E-327, E-328
1	Bead Thermistor		1/2 x 1/8 OD				R-204
2	Disc Thermistor		1 1/4	7/8	5/16		R-349, R-355

4. EQUIPMENT REQUIRED BUT NOT SUPPLIED.

No equipment is required which is not supplied.

5. GENERAL ELECTRICAL CHARACTERISTICS.

Signal Generator TS-418/U provides output RF signals at any desired frequency within the range of 400 to 1000 megacycles per second and at any desired level within the range of 0.2 to 200,000 microvolts (120 to 0 db below one milliwatt) across its rated load of 50 ohms resistance. Both the desired frequency and desired level of output RF signals are selected and indicated by means of directly calibrated front panel controls.

The Signal Generator TS-418/U is designed to operate from an external source of power, furnishing power at a nominal 115 volts, 50 to 1600 cycles per second, and when furnished with this power requires approximately 130 watts at a power factor of approximately 0.9.

The instrument is versatile, providing either continuous wave or pulse modulated RF signals derived from an internal pulse modulator. In addition, the instrument is capable of providing either pulse modulated or sine wave modulated RF signals when furnished with appropriate modulating signals from an external source. Circuits and controls are included for adjusting the repetition rate and width of pulse RF signals when such signals are derived from the internal modulator. The internal modulator may be operated either free-running or synchronized with pulse or sine wave signals from an external source. In addition to the output RF signal, Signal Generator TS-418/U also provides two separate output synchronizing signals for external use in synchronizing pulse RF signals with external equipment. One of these, the undelayed output synchronizing signal is a pulse approximately coincident with external synchronizing signals. The other, the delayed synchronizing signal, is approximately coincident with the pulse output RF signal. A delay circuit is included to allow the output RF signal (and thus the delayed synchronizing signal) to be delayed so as to occur by an adjustable interval of time after the undelayed synchronizing signal.

Further information on the detailed electrical characteristics of Signal Generator TS-418/U is given in Section V of this handbook in Table 5-1, "General Characteristics".

6. GENERAL DESCRIPTION.

Signal Generator TS-418/U is unusual among equipments in its frequency range in that it is directly calibrated in output frequency as well as in output power. The wide frequency range is covered in one continuous band and the output frequency is selected by means of a single calibrated dial. Thus no conversion charts or critical multiple adjustments are necessary either for selecting output frequency or power.

The circuit which generates the RF signals consists of a type 2C36 uhf triode operating with an external resonant cavity in conjunction with a concentric transmission line both of whose electrical lengths are adjustable by movable plunger-type shorting contacts under front panel control. This arrangement makes possible the calibration of the tuning dial directly in frequency, an unusual feature at these frequencies.

A standby heater is provided in the instrument for the purpose of maintaining the temperature within the instrument case higher than the ambient temperature during periods of intermittent use. This feature is included to prevent the frequent condensation of moisture within the instrument case and to reduce the relative humidity to prevent fungus attack.

Signal Generator TS-418/U may be placed in any position where its operating angle is not greater than 45°.

Physically, the signal generator is relatively small in size, the maximum overall size being only 17⅝ inches long x 12⅜ inches high x 13½ inches deep. The front panel is provided with stainless steel guard rail type handles for use both to carry the instrument and to protect front panel controls and connections. Aluminum mounting feet are provided on both the bottom and back sides of the instrument case.

Structural parts, including the front panel and the instrument case, are made of aluminum alloy. The chassis of the instrument is mounted horizontally, at a right angle to the front panel. Small components such as composition resistors and mica capacitors are, for the most part, mounted on phenolic terminal boards.

The instrument case can be removed by taking out the two inner 10-32 screws from the bottom of the case and loosening the eight Lion fasteners spaced around the outer edges of the front panel. These screws should be given a quarter-turn only in the

Figure 1-2. Transit Case CY-741/U

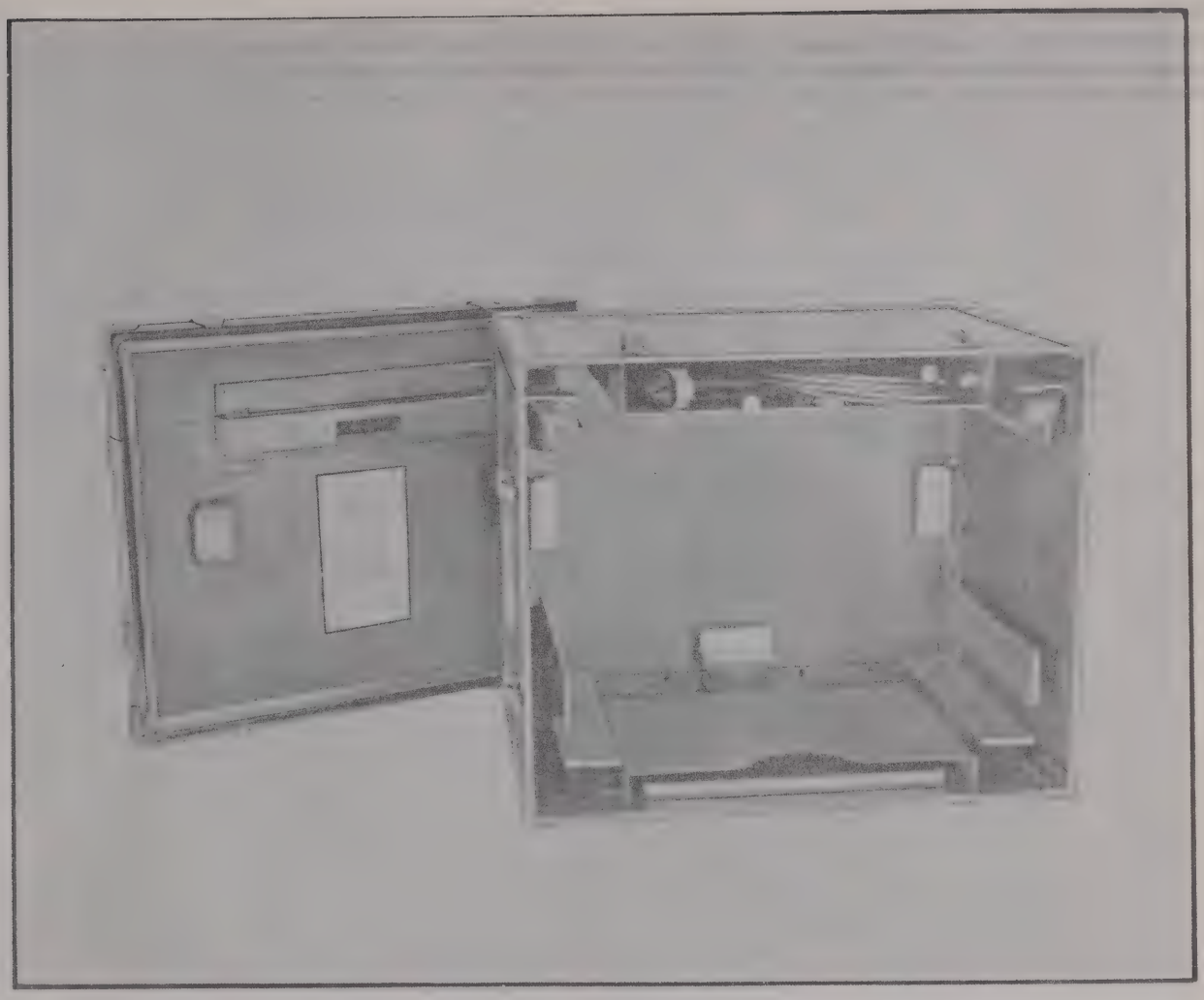


Figure 1-3. Transit Case CY-741/U—Interior View

counterclockwise direction. The unit may then be slid out of its case.

Ventilation is provided by louvres in the side and back surfaces of the instrument case and by holes in the bottom of the case. All openings are covered by wire screen to prevent entry of foreign material and to minimize RF leakage.

7. TRANSIT CASE CY-741/U.

Transit case CY-741/U is provided with Signal Generator TS-418/U and is shown in figure 1-2. This case is designed to be water-tight and provides wall compartments for mounting the cables and this handbook, as shown in figure 1-3. The other accessories and operating spares shown in figure 1-1 are mounted in the elongated box affixed to the underside of the transit case cover. The hinged lid of this box is equipped with slidesnap fasteners to permit secure closing. Four Allen wrenches required for making control adjustments are mounted by means of Fabnestock clips located at the ends of the accessory box.

The transit case is constructed of a special laminated material consisting of balsa wood covered on each side with aluminum sheeting. The cover for the instrument case is provided with a double lip which is filled with sponge rubber. The double lip effects a water-tight seal when the cover for the case is closed. The cover is attached to the case by eight trunk-type latches.

8. ACCESSORIES.

The accessories supplied with Signal Generator TS-418/U are shown in table 1-1.

a. Cable CG-546/U(6'0")(W-203) is the RF output cable and consists of approximately six feet of RG-55/U coaxial cable with a JAN type UG-88/U

type BNC plug at each end.

b. Cord CG-546/U(8'0") consists of approximately eight feet of cable RG-55/U terminated at each end with a JAN type UG-88/U BNC plug. Two cords of this type (W-301 and W-302) are provided to permit the transmission of any two separate signals, either two synchronizing or a synchronizing and an external modulating signal, in a variety of combinations.

c. Cord CX-337/U (6'0") (W-101) is provided for connecting the power plug on the instrument to the ac supply. The cord consists of approximately six feet of two-conductor cable with a conventional male power plug (Hubbell 7057) on one end and a female plug (Hubbell 7084) on the other.

d. Adapter UG-201/U (E-208) is provided for connecting a JAN type UG-22/U or similar type N connector at one end with a JAN type UG-88/U or similar type BNC connector at the other end.

e. Adapter UG-255/U (E-211) is provided to mate with a JAN type UG-290/U or similar type BNC connector at one end with a JAN type number 49194 or similar uhf type connector at the other end.

f. Adapter UG-273/U (E-205) is designed to mate with a JAN type UG-88/U or similar uhf connector at one end and with a JAN type number 49194 or similar uhf connector at the other end.

g. Fuses to replace F-101 and F-102 are provided in the transit case. Five spare fuses are provided, three being located in the transit case and two in the spare fuse-holders on the front panel of the signal generator.

h. Pilot lamps to replace E-107 and E-108 are also provided in the transit case cover to replace the lamps in the holders on the front panel of the instrument when necessary.

9. QUANTITY AND TYPES OF TUBES AND LAMPS.

Fifteen electron tubes and two indicator lamps are used in Signal Generator TS-418/U as listed in table 1-2. Table 5-1 gives the functions and reference symbols of the tubes.

10. INTERCHANGEABILITY.

Except for the presence in Signal Generator TS-418A/U of a shield which completely surrounds the cavity section of the RF Oscillator and of filters attached to the shield for all the electrical leads to the cavity in order more effectively to suppress RF leakage from the instrument, Signal Generators TS-418A/U and TS-418/U are identical and are, therefore, interchangeable.

TABLE 1-2. TUBES AND INDICATOR LAMPS

JAN or Navy Type	Quantity	JAN or Navy Type	Quantity
6AG7	2	12AX7	1
6AK5	1	0B2	2
6J6	5	5R4GY	1
2C36	1	5Y3GT	1
12AT7	1		

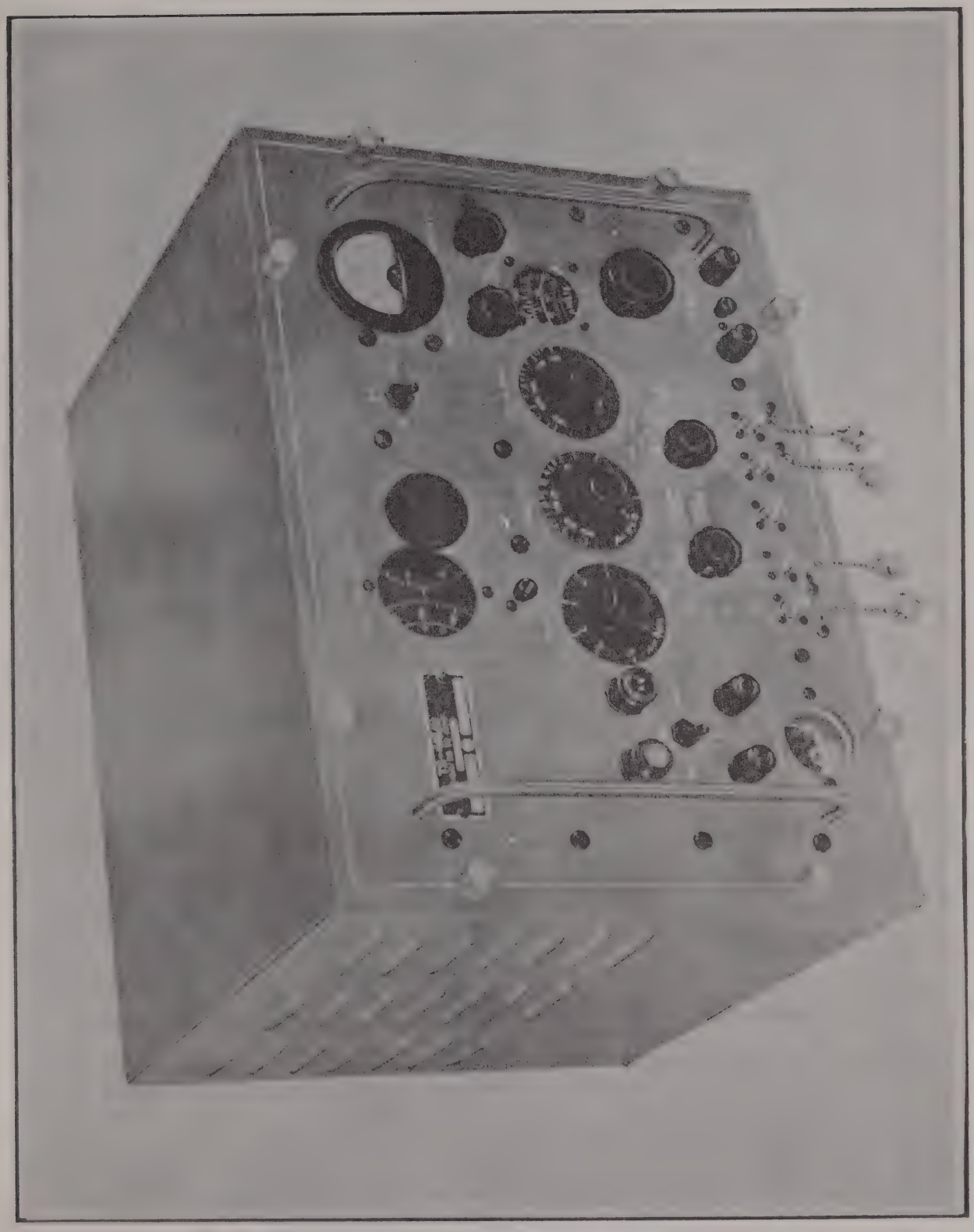


Figure 1-4 Signal Generator TS-418/U—Oblique View

SECTION II
OPERATION AND ADJUSTMENT

1. FUNCTION OF EQUIPMENT.

Signal Generator TS-418/U is designed to provide RF signals at any desired frequency within the range from 400 to 1000 megacycles. These RF signals can be continuous wave, amplitude modulated by external signals, or modulated by internally generated pulses, or directly by externally supplied positive or negative pulses. The internally generated pulses used for modulation may also be synchronized with external positive or negative pulses or sine waves. For synchronized or unsynchronized pulse modulation, the pulsed RF output can be delayed over a range from 3 to 300 microseconds relative to the undelayed output synchronizing pulse. Signal Generator TS-418/U also provides two output pulses for synchronizing external equipment, one of which is delayable so that it is substantially coincident with the RF pulse.

TABLE 2-1. OPERATING CONTROLS, DIALS AND TERMINALS

REFERENCE NO.	DESIGNATION	FUNCTION
1	POWER INPUT	Power connector
2	POWER	Power switch. In the ON position the instrument is on; in the opposite position the space heater is on and the instrument is off.
3	ON	Pilot lamp (red) that indicates space heater is off and circuits are energized.
4	OFF	Pilot lamp (white) that indicates space heater is on and circuits are not energized.
5	SIGNAL FREQUENCY MC	Main tuning dial and control knob.
6	MODULATION SELECTOR—CW; PULSE: INT, EXT POS; EXT NEG; AM	Oscillator modulation selector switch.
7	RF	Turns RF oscillator ON or OFF.
8	ZERO SET	Meter zero set control.
9	POWER SET	Output level reference meter.
10	PWR SET	Control which adjusts reading of power level meter.
11	OUTPUT ATTENUATOR	Output attenuator control and output level indicating dial.
12	SYNC SELECTOR	Adjusts Modulator so that it will synchronize with various types of external voltages; also allows Modulator to generate pulses internally.
13	PULSE RATE	Selects pulse repetition rate when Modulator generates internal pulse.
14	PULSE DELAY	Determines delay in microseconds between external synchronizing pulse and start of output RF pulse.
15	PULSE WIDTH	Determines width in microseconds of output RF pulse.
16	RF OUTPUT	Terminal at which RF output is obtained.
17	EXT MOD	Terminal to which external modulating voltage is applied.
18	SYNC IN	Terminal to which external synchronizing voltage is applied.
19	SYNC OUT	Terminal at which undelayed positive synchronizing pulse is obtained.
20	DELAYED SYNC OUT	Terminal at which delayed positive synchronizing is obtained; this pulse is approximately simultaneous with start of RF pulse.
21	LINE	Holder for 3 ampere line fuse.
22	SPARE	Holder for spare 3 ampere line fuse.
23	LINE	Holder for 3 ampere line fuse.
24	SPARE	Holder for spare 3 ampere line fuse.
25	LOCK	Clamp to lock frequency drive mechanism at any setting.
26	LOCK	Clamp to lock attenuator drive mechanism at any setting.

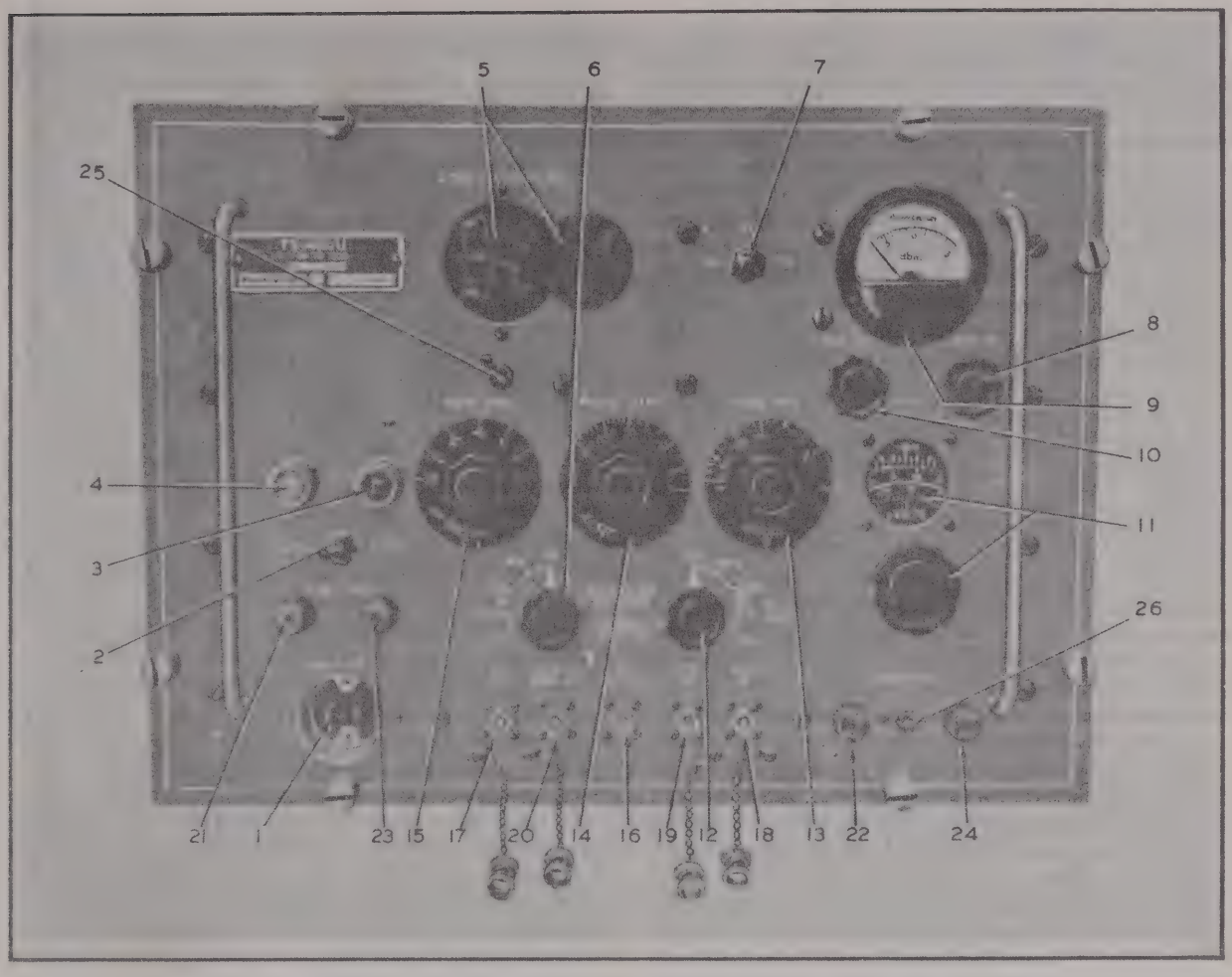


Figure 2-1. Signal Generator TS-418/U, Front Panel Controls

2. OPERATING CONTROLS, DIALS AND TERMINALS.

a. CONTROLS.—All controls necessary for the operation of the instrument are located on the front panel. Figure 2-1 shows the front panel of instrument, with the name of each control indicated on the adjacent panel engraving. The controls, dials and terminals are listed in Table 2-1 with their names and functions simply indicated. The numbers arbitrarily shown in column one are used throughout this section for convenient reference to the controls.

At least seven different functions can be fulfilled by this signal generator, but since most of them involve the use of the uhf oscillator, the controls and procedure for adjusting this oscillator are considered first.

b. OSCILLATOR CONTROLS.

(1) The main tuning dial marked SIGNAL FREQUENCY MC (number 5 in Table 2-1) is calibrated directly in megacycles from 400 to 1000 megacycles and is the dial for indicating the frequency of the UHF Oscillator. The setting of the main tuning dial is adjusted by front panel control associated with it. This control rotates a small vernier dial with scale reading from 0 to 100 and drives the main frequency dial, the two being linked together in a 24 to 1 gear ratio. In addition to being directly calibrated in frequency, the main dial is also calibrated for every full turn of the vernier dial. For convenience the latter is linearly scaled from 0 to 24. This feature permits convenient resetting of the main dial.

(2) The MODULATION SELECTOR switch (number 6) selects the type of modulation desired from a variety of choices: continuous wave (C.W.), internal pulse modulated, external positive pulse modulated, external negative pulse modulated, or external amplitude modulated. Before setting this control for any specific condition of operation the RF switch (number 7) should be set to the OFF position, and the power level meter (number 9) set to the ZERO SET mark by means of the ZERO SET control (number 8).

This procedure balances the thermistor bridge for zero RF conditions.

The Oscillator modulation selector switch (number 6) should then be set to the CW position and the PWR SET control (number 10) adjusted so that the power level meter pointer is exactly at the mid-scale reference mark. This procedure insures that a standard level of RF is impressed across the attenuator output system of the system, and even though the pulsed output may be desired the procedure is useful because it establishes the peak level of the RF pulses.

If the RF frequency is in the vicinity of 400 or 1000 megacycles, it may not be possible to reach the POWER SET line. In this case it should be set to the nearest dbm mark and the indicated number of decibels should be algebraically added to the dbm scale on the OUTPUT ATTENUATOR dail.

The output power level is set by number 11, the OUTPUT ATTENUATOR control with dial directly calibrated in microvolts and in decibels. At its 0 setting the RF output power is one milliwatt, provided the POWER SET meter indication is also 0, and at its extreme clockwise setting (showing maximum attennation) the RF output power is —120 dbm (120 db below one milliwatt). The power and voltage calibration is based upon the assumption that the instrument is working into a 50 ohm resistive load, the load for which the instrument was designed. With MODULATION SELECTOR switch (6) set to AM, the RF carrier can be amplitude modulated to a depth of 30% by externally derived voltages ranging in frequency from 100 to 100,000 cps. Since the RF monitor is a power measuring device its reading will increase when the modulating power is added. To check the percentage of modulation on the POWER SET meter, the unmodulated RF power must first be standardized by repeating the zero-setting operation described in paragraph *b*, (2) of this section. Then with the POWER SET meter set to read 0 db (1 milliwatt) for CW output, if the MODULATION SELECTOR Switch is then set to AM and modulating power is added until the meter reading increases to 0.191 db, the RF carrier will be modulated 30%. The basis for this procedure is explained in paragraph 9, *b*, (4), (a) of Section IV.

c. MODULATOR CONTROLS.—There are four controls provided for adjusting the Modulator for the desired type of operation: SYNC SELECTOR switch (number 12) PULSE RATE (number 13), PULSE DELAY (number 14), and PULSE WIDTH (number 15).

(1) The PULSE WIDTH control is calibrated approximately from 0.5 to 10 microseconds and determines and indicates the duration of the RF pulse obtained from the signal generator. As calibrations are accurate only within 0.35 microsecond for pulse widths of one microsecond or less and within 25% for pulses over one microsecond in width, when it is desirable to know the RF pulse width more accurately the pulse width should be measured on a synchroscope. Also, if the carrier frequency is changed and the PULSE WIDTH control is kept constant, the width of the output RF pulse may change in the order of 0.7 microsecond, owing to the characteristics of the Oscillator tube.

(2) The PULSE DELAY control is calibrated in a single range from 3 to 300 microseconds. This control determines and indicates the time interval (or delay) between the SYNC OUT signal (undelayed output synchronizing signal) and the RF output pulse. In cases where the RF output pulse signal is being synchronized with a signal from an external source, the external synchronizing signal and the SYNC OUT signal are practically coincident. The PULSE DELAY control, thus determines and indicates the time interval between the external synchronizing signal and RF output signal when the RF output signal is being synchronized from an external source. Maximum delay of 300 microseconds cannot be used when the prf is higher than about 2500 pps because the interval between pulses approaches 300 microseconds and the operation of the Pulse Delay Multivibrator then tends to become unstable. Further, as the prf is increased above 2500, less and less delay can be used until at the highest usable prf of 4000 pps, a delay of about 187 microseconds is the maximum delay that can be used. In any case the delay used should not be more than 75% of the period between pulses.

Inasmuch as the PULSE DELAY control affects the time-phase of the output RF pulse and inasmuch as the start of the output RF pulse is approximately concurrent with the start of the DELAYED SYNC OUT pulse, it should be noted that the PULSE DELAY control affects the time-phase of the DELAYED SYNC OUT pulse as well as that of the output RF pulse.

The PULSE DELAY dial calibrations are accurate within 25% for delays exceeding 12 microseconds and within 3.5 microseconds for delays less than this. Therefore, in applications where the interval between the start of the external synchronizing pulse and the start of the RF pulse and/or the DELAYED SYNC OUT pulse must be known accurately, this delay interval should be measured on a synchroscope.

(3) The PULSE RATE control is calibrated from 40 to 400 pps and this calibration is multiplied by the first two positions (X1 and X10) of the SYNC SELECTOR switch. Hence, the PULSE RATE control allows direct selection of pulse rates from 40 to 400 pps on the X1 range and from 400 to 4000 pps on the X10 range.

The calibration of the PULSE RATE control is designed to be accurate within 25% and in applications where it is desired to know the pulse repetition rate accurately, the rate should be measured externally.

(4) The SYNC SELECTOR switch allows the Modulator to be synchronized with various types of external voltages and also allows the Modulator to

generate pulses having a repetition rate determined by the setting of the PULSE RATE control as described above.

The SINE WAVE position of the switch allows the Modulator to be synchronized with external sine wave voltages having an RMS value between 10 and 50 volts and a frequency between 40 and 4000 cps.

The POS and NEG positions of the switch allow the Modulator to be synchronized with positive and negative pulses respectively having a peak amplitude between 10 and 50 volts and a repetition rate between 40 and 4000 pulses per second. The external synchronizing pulse must have a duration between 0.5 and 20 microseconds between its half-voltage points and a rise time of less than 0.5 microsecond between 10% and 90% of maximum amplitude.

d. OUTPUT TERMINALS.—Three output terminals are provided on Signal Generator TS-418/U, the most important being the RF OUTPUT terminal. At this terminal the RF output signal is obtained from the instrument.

The SYNC OUT terminal provides a positive undelayed synchronizing pulse for external use. The leading edge of this pulse occurs within 0.5 microsecond of the leading edge of the external synchronizing pulse when the Modulator is synchronized with external pulses. The SYNC OUT pulse has a minimum amplitude of 25 volts and a duration of not more than 5 microseconds when loaded with rated load. The amplitude of the pulse is affected by the load that is used. The terminal is designed to be worked into loads ranging from 500 to 100,000 ohms resistive and shunted by not more than 1500 micromicrofarads. Minimum duration of the SYNC OUT pulse is obtained with loads of low capacity and low resistance.

The rise time of the SYNC OUT pulse is less than 0.5 microseconds when obtained across the specified load.

The DELAYED SYNC OUT terminal also provides a positive video pulse for external use. However, this pulse is primarily different from the pulse available at the SYNC OUT terminal in that it occurs later than the SYNC OUT pulse by the amount indicated by the setting of the PULSE DELAY control. In other words, the DELAYED SYNC OUT pulse always occurs from 3 to 300 microseconds later than the SYNC OUT pulse. The characteristics of DELAYED SYNC OUT pulse are similar to those of the SYNC OUT pulse, having a peak amplitude of at least 25 volts, a duration of not more than five microseconds, and a rise time of less than 0.5 microseconds. The DELAYED SYNC OUT terminal also is designed to be worked into loads ranging from 500 to 100,000 ohms resistive shunted by not more than 1500 mmf. The capacitive component of the load affects the duration of the pulse in a manner similar to that of the SYNC OUT pulse.

The distinctions between the three output pulses which are generated by Signal Generator TS-418/U can be summarized as follows: All three pulses have the same repetition rate; however, the RF OUTPUT pulse consists of a pulsed RF carrier, whereas the SYNC OUT and DELAYED SYNC OUT pulses are rectangular video pulses. In addition, the RF OUTPUT and DELAYED SYNC OUT pulses start essentially at the same time; while, the SYNC OUT pulse starts from 3 to 300 microseconds earlier. The RF OUTPUT pulse is adjustable in duration over a range from 0.5 to 10 microseconds, while the duration of the SYNC OUT and DELAYED SYNC OUT pulse is not adjustable although it is affected somewhat by the characteristics of the load used.

When Signal Generator TS-418/U is modulated by pulses from an external source there is essentially no time lag between the application of the modulating signals and either the pulsed RF OUTPUT signals or the DELAYED SYNC OUT pulses. With the MODULATION SELECTOR switch set to AM, no DELAYED SYNC OUT pulses are provided for external use. However, when Signal Generator TS-418/U is externally modulated by either pulse or sinusoidal waves while the SYNC SELECTOR switch is set to X1 or X10, synchronizing pulses may be obtained at the SYNC OUT jack, but in this case they are wholly unrelated to the external modulating signals.

e. INPUT TERMINALS.—Two input terminals are provided on Signal Generator TS-418/U: the EXT MOD terminal (number 17) and the SYNC IN terminal (number 18). The EXT MOD terminal is provided to permit modulation of the RF output by external positive or negative pulses of from 40 to 70 volts or by sinusoidal waves with an amplitude not exceeding three volts peak if undistorted output is desired. For external modulation, control number 6 must be set according to the type of modulating voltage applied.

The SYNC IN terminal is provided for connecting to the external synchronizing voltage when it is desired to synchronize the Modulator with an external pulse or sine wave voltage. These external synchronizing voltages should have the characteristics described above in paragraph 2, *c*, (4), which explained the operation of the SYNC SELECTOR switch.

f. TIME RELATIONS OF INPUT AND OUTPUT SIGNALS.—The timing relations existing among the input and output signals of Signal Generator TS-418/U may be more clearly established by referring to the timing diagram, figure 7-5, Section VII, and may be checked against the waveform data included in the Modulator block diagram, figure 3-5, Section V.

g. POWER TERMINAL.—The POWER INPUT terminal (number 1) is provided for connecting to the power line. This terminal should be connected to a nominal 115-volt, 50 to 1600 c.p.s. single phase power source by means of power cord CX-337/U (6′0″) which is provided with the signal generator.

3. STEP-BY-STEP OPERATING PROCEDURE.

a. POWER CONNECTION.—Connect the power plug (number 1) of Signal Generator TS-418/U to a nominal 115-volt, 50 to 1600 c.p.s. single phase power source and turn on the power switch (2). Allow the instrument to heat for a minimum of five minutes. If ambient temperature is below about 10°C(50°F), a longer warm-up period of 30 minutes or more is desirable, especially if accuracy of output power is important.

CAUTION

If Signal Generator TS-418/U has been subjected to conditions causing moisture condensation (such as rapid changes in temperature), allow the instrument to heat for as long a time as possible before using. Signal Generator TS-418/U has been designed to withstand extremes in temperature, but it is desirable to dry any condensed moisture.

b. ADJUSTING THE OSCILLATOR.

(1) Set main tuning dial to desired frequency by means of control 5.

(2) Connect external load to RF OUTPUT terminal (16). This load should be 50 ohms resistive. Cable CG-546/U(6'0") is provided for convenience in making this connection.

(3) Set Control 7 to OFF position and adjust ZERO SET control so that power level meter reads exactly at ZERO SET (index line at left end of meter scale arc).

(4) Set control 6 to CW position and control 7 to ON and adjust PWR SET control so that power level meter pointer is at the 0 dbm mark at half scale on the meter.

(5) Adjust OUTPUT ATTENUATOR control until the dial indicates desired output power or voltage.

(6) Continuous wave output will now be obtained from the Signal Generator TS-418/U. If pulse or amplitude modulated output is desired, see the following.

c. TO USE THE MODULATOR AS A FREE-RUNNING PULSE MODULATOR.

(1) Set SYNC SELECTOR switch to X1 or X10 position and adjust PULSE RATE control so that desired repetition rate from 40 to 4000 pps is indicated.

(2) Adjust PULSE WIDTH control for desired pulse width between 0.5 and 10 microseconds.

(3) If the timing of the RF pulse is not suitable for use with the external equipment, such as the range scope of the receiver, adjust the PULSE DELAY control as necessary.

d. TO SYNCHRONIZE THE MODULATOR WITH AN EXTERNAL VOLTAGE.

(1) Connect the external synchronizing voltage to SYNC IN terminal. Video cable CG-546/U(8'0") is convenient to use in making this connection.

(2) Set the SYNC SELECTOR switch to the POS, NEG or SINE position, depending upon the type of external synchronizing voltage to be used.

(3) Adjust the PULSE WIDTH control for the desired RF pulse width between 0.5 and 10 microseconds.

(4) If the timing of the RF OUTPUT pulse, in relation to the SYNC IN pulse, is not suitable for use with the external equipment, adjust the PULSE DELAY control as necessary.

e. TO MODULATE THE OSCILLATOR WITH AN EXTERNAL PULSE.

(1) Connect the external pulse voltage to the EXT MOD terminal of Signal Generator TS-418/U The external modulating pulse should have the characteristics described in paragraph 2*e* above. Video cable CG-546/U(8'0") is convenient to use in making this connection.

(2) Set switch 6 to the EXT NEG or EXT POS position, depending upon the polarity of the modulating voltage. With switch 6 in this position, the RF signal cannot be amplitude modulated properly by sinusoidal waves regardless of their amplitude.

f. TO AMPLITUDE MODULATE THE OSCILLATOR WITH SINUSOIDAL WAVES.

(1) Set switch 6 to AM position.

(2) Connect the external sinusoidal voltage to the EXT MOD terminal of the Signal Generator TS-418/U. With switch 6 set to AM it is not possible to pulse modulate the RF carrier 100%, that is with blank periods between the pulse periods.

g. TO OBTAIN A TRIGGER FOR EXTERNAL USE.

(1) Two trigger voltages for external use are provided both when the Modulator is free-running and when synchronized with an exteral voltage.

(2) A positive video pulse is obtainable from the SYNC OUT terminal. This pulse is not capable of being delayed in any way.

(3) A positive video pulse is obtainable from the DELAYED SYNC OUT terminal. This pulse is essentially synchronous with the RF pulse generated by the instrument and is thus delayable over a range from 3 to 300 microseconds relative to the pulse signal furnished at the SYNC OUT terminal.

(4) In cases where the Oscillator is modulated by an external pulse, a positive video pulse also is obtainable from the DELAYED SYNC OUT terminal. In some conditions a pulse is obtainable from the SYNC OUT terminal when the Oscillator is externally modulated; however, this pulse bears no relation whatsoever to the output RF pulse or the external modulating pulse.

4. HEATER OPERATION.

The instrument may be shut off while in any operating sequence by turning the power switch (number 2) off. This disconnects the a-c power from the power supply and leaves only the heater connected and in operation. In humid climates such operation is desirable when the instrument is idle to prevent excessive moisture condensation. The power cord must be removed from the POWER INPUT receptacle (number 1) on the front panel in order to remove power from the instrument entirely.

5. MISCELLANEOUS.

A discussion of miscellaneous factors involved in the operation of a uhf signal generator is included in Section V under paragraph 3.

SECTION III
THEORY OF OPERATION

1. INTRODUCTION.

Note

This handbook applies equally to Signal Generator TS-418A/U and to Signal Generator TS-418/U. Specific differences between the two instruments will be described in this Section as required to explain the theory of operation.

Signal Generator TS-418/U provides output RF signals at any desired frequency within the range of 400 to 1000 megacycles per second and at any desired level within the range of 0.2 to 200,000 microvolts (120 to 0 db below one milliwatt) across its rated load of 50 ohms resistance. Both the desired frequency and the desired level of output RF signals are selected and indicated by means of calibrated front panel controls.

The instrument is versatile, providing either continuous wave or pulse modulated RF signals derived from an internal pulse modulator. In addition, the instrument is capable of providing either pulse modulated or sine wave modulated RF signals when furnished with appropriate modulating signals from an external source. Circuits and controls are included for adjusting the repetition rate and width of pulse RF signals when such signals are derived from the internal modulator. The internal Modulator may be operated either free running or synchronized with pulse or sine wave signals from an external source. In addition to the output RF signal, the TS-418/U also provides two separate output synchronizing signals for external use in synchronizing pulse RF signals with external equipment. One of these, the undelayed output synchronizing signal is a pulse approximately coincident with external synchronizing signals. The other, the delayed synchronizing signal is approximately coincident with the pulse output RF signal. A delay circuit is included to allow the output pulse RF signal (and thus the delayed synchronizing signal), to be delayed to occur by an adjustable interval of time after the undelayed synchronizing signal.

Further information on the detailed electrical characteristics of Signal Generator TS-418/U is given in Section V of this handbook under Table 5-2, "General Characteristics".

2. BLOCK DIAGRAM.

The basic circuit of Signal Generator TS-418/U consists of four sections shown in figure 3-1: the Modulator, the RF Oscillator, the output system, and the Power Supply. The Modulator keys the Oscillator to produce the desired type of RF output. The output system determines the amount of RF power available to the load and includes a direct-reading output level control. The Power Supply provides plate and filament power for the Modulator and Oscillator. A complete schematic diagram of the system is given in figure 7-1 in Section VII. Each of the four basic sections of the circuit is described in detail below.

3. RF OSCILLATOR.

The RF Oscillator is the heart of Signal Generator TS-418/U, generating the RF power which is delivered to the external load. The Oscillator circuit employs a uhf type triode 2C36, (V-201) operating with an external resonant cavity. The entire assembly includes a pair of concentric transmission lines effectively open at their input ends and closed at their output ends. These two transmission lines are built up mechanically of three metal cylinders mounted coaxially, one within the other. The quarter-inch innermost cylinder contacts the cathode of the tube directly. The one-inch cylinder which encloses it is coupled thru an air capacitor of low value to the grid, and the two-inch outer cylinder

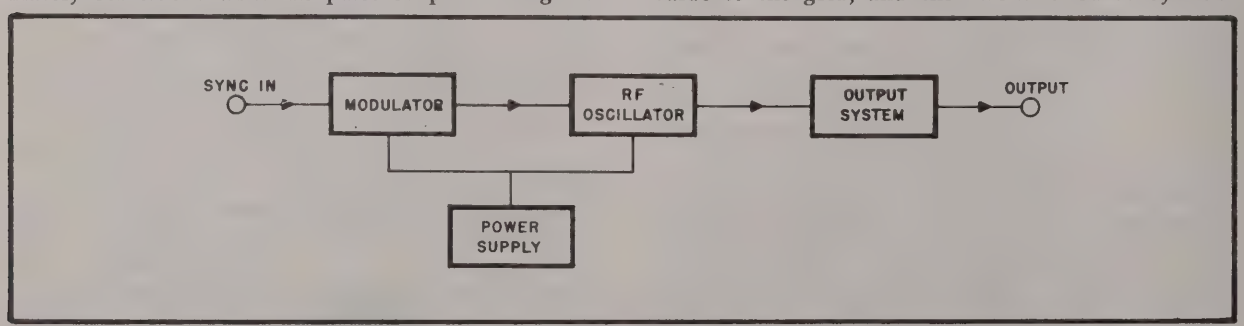


Figure 3-1. Signal Generator TS-418/U, Circuit Block Diagram

is similarly coupled to the plate.

The outer concentric line built up of the two outer cylinders constitutes the resonant cavity. This line is short-circuited at a point one-quarter wave-length from the input, forming, electrically, the equivalent of a parallel resonant circuit between the plate and the grid. Since the inner concentric line is short-circuited slightly beyond the quarter-wave point, it presents a capacitive reactance between the grid and the cathode. A 1/8 inch screw set into the outer (plate) cylinder passes through a 3/8 inch feedback hole in the center (grid) cylinder and extends down into the grid-cathode transmission line, introducing a small capacitance between the plate and the cathode. Properly set, the feedback screw (H-208) tends to reduce spike-like overshoot of the leading edge of the pulse RF signal, but also causes an unequal frequency shift over the dial, upsetting the accuracy of calibration. In the TS-418A/U this effect is largely overcome by the tuning screw, H-232, which produces a band-spread effect by introducing additional capacitance between the plate and grid cylinders. A half-moon shaped loading slug mounted on the inner wall of the grid cylinder in close proximity to the cathode cylinder tends to suppress higher mode oscillations.

Thus, electrically, in addition to the parallel resonant circuit capacitively coupled between the plate and the grid, the complete Oscillator circuit includes two capacitances connected in series between the plate and grid with the cathode lead tapped between them. These relationships are shown schematically in figure 3-2, from which it will be seen that the resonant line Oscillator is equivalent, electrically, to the familiar Colpitts' Oscillator circuit.

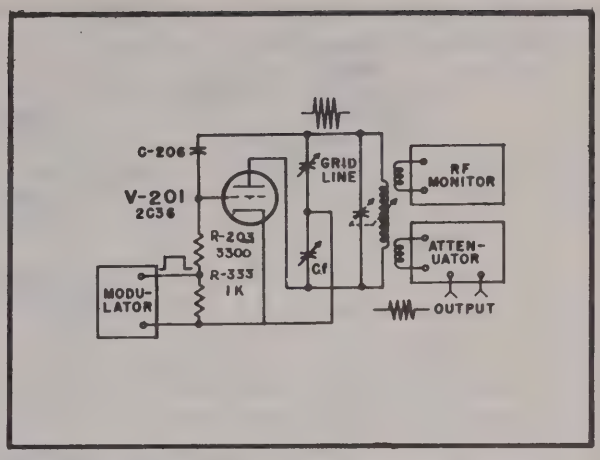


Figure 3-2. Equivalent Oscillator Circuit

The frequency of oscillation is determined by the frequency to which the plate line is resonant. By changing the position of the plunger contact which shorts the line, the resonant frequency of the line also changes. A similar shorting contact is located in the grid-cathode line. Both shorting contact plungers are secured to the same geared drive mechanism so that both are moved in unison by a control on the front panel, by means of which the output frequency Signal Generator TS-418/U may be varied over its entire frequency range from 400 to 1000 megacycles. A cutaway view of portions of the mechanical assembly of the oscillator is shown in figure 3-3. The

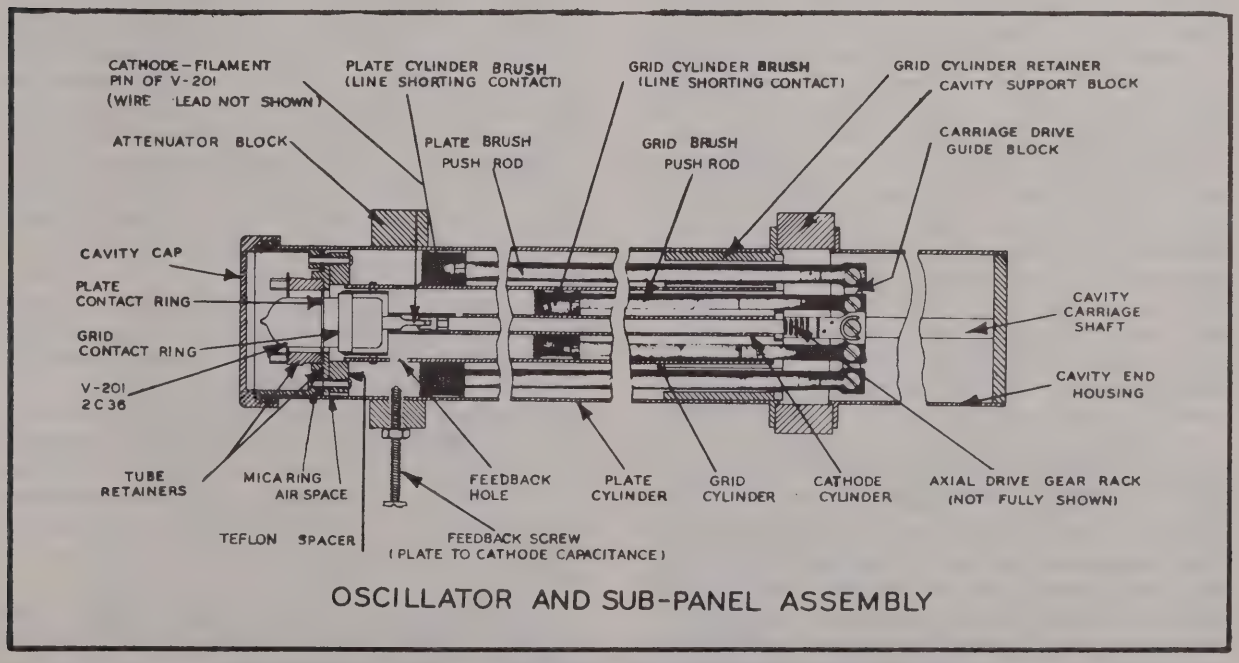


Figure 3-3. Cutaway View of Portions of UHF Oscillator Assembly

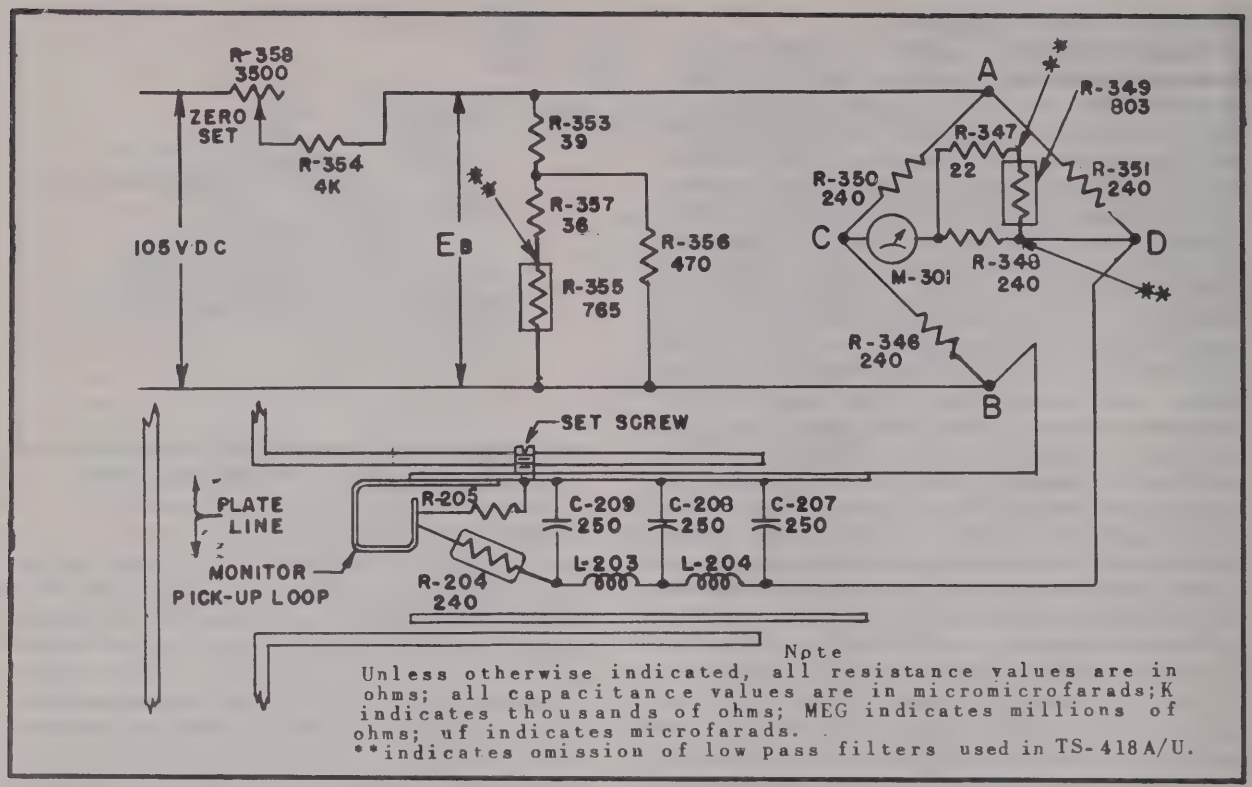


Figure 3-4. Monitor Circuit

complete assembly is shown in detail in the exploded view, figure 7-10 of Section VII.

a. RF OUTPUT—The pick-up loop by means of which the RF output power is obtained from the resonant cavity operates in a small section of circular waveguide which opens into the resonant cavity. The cross-sectional area of the waveguide is sufficiently small so that energy is usually considered not to be propagated directly down the wave-guide; that is the waveguide is smaller than the cut-off size of waveguide for the frequencies generated by the oscillator. However, a small amount of energy *is* propagated down the guide, and this energy decreases exponentially at the rate of 32 decibels in a distance equal to the diameter of the tube, that is one-half inch. Since the output power in decibels is proportional to the square of the voltage obtained, it is possible to move the pick-up in the waveguide by means of a gear system and to calibrate the gear system linearly in decibels of output power. This has been done in Signal Generator TS-418/U, providing a directly calibrated power-output system.

The RF output power is coupled by the pickup loop in the attenuator waveguide section through a 57 ohm resistor, which matches the power source impedance of the system to the impedance of the output transmission line. The method of mounting this resistor, R-202, to the high potential side of the pickup loop, which is shown in the cutaway view of the attenuator unit in figure 3-5, insures a very low standing wave ratio.

b. RF MONITOR.—To determine the power applied through the attenuator to the external load, the voltage or current applied to the load as well as the load itself must be known. In Signal Generator TS-418/U, the fields within the Oscillator cavity are monitored by a thermistor bridge circuit. The bridge is balanced for dc conditions and when the RF power from the resonant cavity is applied to the circuit, the bridge becomes unbalanced, the amount of unbalance being indicated by a microammeter connected across the bridge and being proportional to the RF power absorbed by the bead thermistor.

The monitor unit, shown in figure 5-5, is piston-shaped like the attenuator unit, and uses an identical pick-up loop. As it operates in a circular waveguide of identical dimensions, equal field strengths are excited in both guides, so that it is possible to place a power measuring device in one waveguide to monitor the field intensity in the other guide. The 68 ohm resistor, R-205, which shunts the bead themistor, R-204, (in series with the first filter capacitor for RF) presents a 50 ohm resistive load to the monitor loop.

RF power is fed by the pick-up loop through a bead thermistor, R-204, to the bridge circuit, which is basically of the Wheatstone type in which the bead thermistor is used as one of the arms. A 200 micro-

ampere meter, M-301, is connected across the bridge to indicate the balance of the circuit. The complete monitor circuit is shown schematically in figure 3-4.

The thermistor bridge circuit used in the instrument is known as a "two-disc" bridge circuit, so called because two disc thermistors are used as sensitivity- and temperature-compensating devices. These two disc thermistors are additional to the bead thermistor used as the RF indicator. Disc thermistor R-349 is connected in series with the meter, acting as a sensitivity-regulating device, and is necessary because of the inherent characteristics of the thermistor bridge to increase in sensitivity as the ambient temperature decreases.

The second disc thermistor, R-355, is shunted across the entire bridge as a balance-regulating device. Because the bead thermistor, R-204, used in the bridge is temperature-sensitive, the bridge would tend to drift appreciably from its zero setting as the cavity temperature increased or decreased. The disc thermistor shunted across the bridge compensates for this tendency by changing its dc resistance so that the dc voltage across the bridge is changed in such a way that the bridge remains in balance even though changes take place in the cavity temperature. This automatic balancing occurs because, by changing the voltage across the bridge, the current through the bead thermistor is also changed, thus changing the resistance of this thermistor. By selective design, the dc voltage across the bridge can be varied so as to keep the resistance of the bead thermistor almost constant over a range of ambient temperatures. Thus, the bridge can be zero-set and will remain in balance to a relatively high degree.

Physically, the two disc thermistors are mounted directly on the monitor-attenuator block so that they are maintained as close to cavity temperature as possible and any changes in the cavity temperature are quickly transferred to the thermistors. Hence, if the cavity temperature changes, the bridge circuit compensates itself so that its sensitivity remains relatively constant and the bridge remains in balance for the zero RF condition.

The strength of the RF fields in the cavity and of the RF output power do not remain constant as the frequency is varied, thus introducing a proportionate error into the attennator scale reading. This error is indicated on the POWER SET meter. To correct it, it is necessary to "restandardize" the power, that is, to restore the level of the fields in the cavity by adjusting the POWER SET control as required to return the meter pointer to the 0 dbm (1 milliwatt) reference line.

Note

The accuracy of the calibration of power output varies slightly with the carrier frequency setting, the maximum error being less than one-half decibel over the whole frequency range. The power output increases gradually below 750 megacycles to a maximum of one-quarter decibel, and decreases gradually the same maximum amount above 750 megacycles.

The RF energy is not permitted to pass from the bead thermistor to the other part of the bridge circuit, being by-passed by the RF filter included in the monitor unit.

4. MODULATOR SECTION.

a. GENERAL.—The Modulator section includes tubes V-301(12AX7); V-302(12AT7); V-303, V-304, V-305(6J6); V-306(6AG7); and V-307, (6J6). The basic function of the Modulator is to generate a positive pulse of desired characteristics and to apply that pulse to the grid of the RF oscillator V-201 (2C36) so that V-201 will oscillate for the duration of the pulse. The pulse can, if desired, be synchronized with an external pulse or sine-wave voltages.

A block diagram of the Modulator section is shown in figure 3-5. The Pulse Rate Blocking Oscillator (second block in figure 3-7) determines the repetition rate of the pulses generated by the Modulator. The Blocking Oscillator can be operated in a free-running condition to produce pulses ranging from 40 to 4000 pps, or it may be triggered by externally applied pulses. In order to synchronize the pulses from the Modulator with external sine waves, the sine waves must first be converted to square waves. This is accomplished in the Limiting Amplifier. These waves are not reduced to short pulses by means of an RC differentiator, but are applied to V-302A (12AT7) as square waves. When thus using sine waves for synchronizing the Modulator, the Blocking Oscillator tube is operated as a straight amplifier.

However operated, the output of the Blocking Oscillator circuit is a negative pulse, the leading edge of which is coincident with the leading edge of the trigger voltage as indicated by time t_1 above the waveform shown in figure 3-5. This negative pulse is differentiated by an RC network, giving a short negative pulse at t_1 and a short positive pulse at a time coincident with the trailing edge of the output pulse. These short pulses are applied to the Series Diode Limiter which is designed to pass only the short negative pulse occurring at time t_1 and to block the positive pulse. This short negative pulse is then applied to and triggers the Delay Multivibrator.

The Delay Multivibrator is provided as a means for supplying a time delay between the external synchronizing voltage and the video pulse which is eventually applied to the RF oscillator V-201 (2C36). The positive pulse generated by the Delay Multivibrator is adjustable from 3 to 300 microseconds and the width of this pulse determines the amount of delay in the circuit. The Delay pulse is differentiated by an RC

network, giving a short positive trigger as the leading edge of the pulse (time t_1) and a short negative trigger at the trailing edge of the pulse (time t_2).

These short pulses are then applied to the Pulse Width Multivibrator. As the latter is insensitive to positive pulses, it is triggered only by the trailing negative pip occurring at time t_2. The Pulse Width Multivibrator generates a large positive pulse adjustable in duration by front panel control over a range from 0.5 to 10 microseconds.

The external pulse which is delayed is obtained at the DELAYED SNYC OUT terminal. The pulses applied to the Pulse Width Multivibrator are inverted and fed to a blocking oscillator stage identical to the one employed for producing the SYNC OUT pulse. The start of the 45 v DELAYED SYNC OUT pulse, taken across the cathode resistor, is approximately coincident with that of the pulse applied to the grid of the uhf triode.

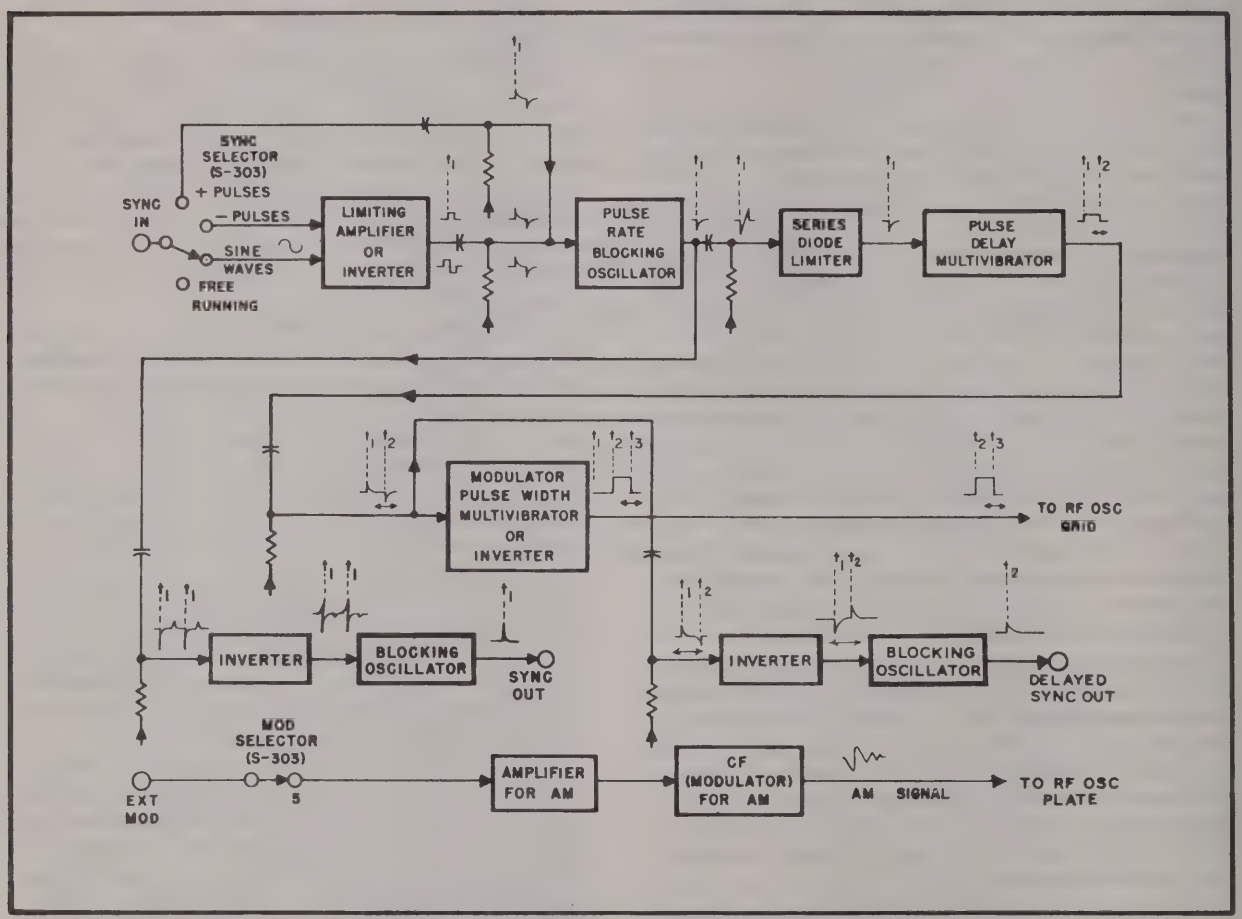


Figure 3-5. Modulator Section Block Diagram

The Modulator also provides two separate synchronizing pulses for external use. One of these is undelayed and one is delayed. The undelayed pulse is provided at the SYNC OUT terminal and is obtained from the negative trigger obtained at time t_1 from the Pulse Rate Blocking Oscillator, V-302A. This negative pulse is applied through an inverting stage to a second Blocking Oscillator whose output, a sharp positive pulse of about 45V is brought out to the SYNC OUT jack. The occurrence of this undelayed SYNC OUT pulse is essentially coincident with the SYNC IN pulse to Signal Generator TS-418/U.

Another function of the Modulator is to allow the oscillator to be modulated by external pulses. The external voltages are applied to one tube of the Pulse Width Multivibrator through the EXT MOD terminal, this tube acting merely as an amplifier in this case.

The waveshapes included in figure 3-5 are idealized to some extent and do not necessarily represent the actual wave form variations occurring in the circuit. Actually, considerable differences in peak pulse amplitudes will exist from stage to stage, and pulse widths will vary widely even in the same stages as the various control settings are changed.

b. PULSE RATE BLOCKING OSCILLATOR.—The intial circuit action of the Modulator section can conveniently be considered as beginning with the Pulse Rate Blocking Oscillator V-302A (12AT7). This circuit, shown at the second block in figure 3-5, is designed to furnish a negative output pulse for the following stage, whether it operates as a true blocking oscillator or merely as an amplifier. Operating alone in a free running condition, V-302 functions as a true blocking oscillator, and the time constant of its associated circuit controls the repetition rate of the pulses ultimately used to modulate the RF output. Operating in conjunction with the Limiting Amplifier (block one in figure 3-5), V-302A functions as a straight amplifier for square waves produced from externally applied sine waves. When operating in the latter condition, it is the frequency of the external sine waves which determines the repetition rate of the pulses eventually used to modulate the RF energy. The final RF output pulses may also be synchronized with external pulses, either positive or negative, and in this case V-302A again operates as a blocking oscillator, disabled by heavy bias until externally triggered. Special switching arrangements have been incorporated to allow each of these four different methods of operation, and each of these methods will be described separately below.

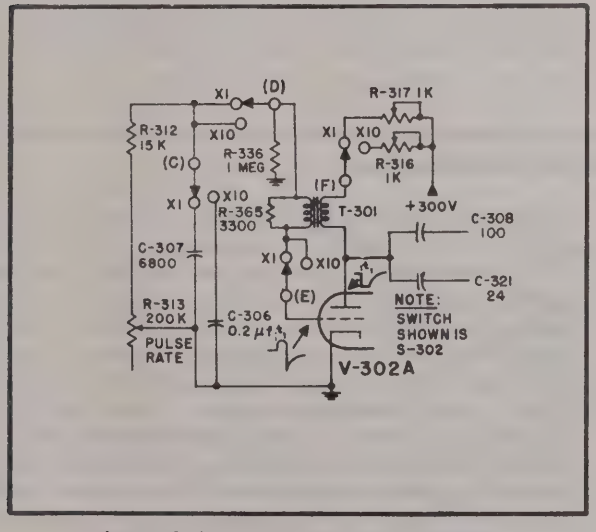


Figure 3-6. Free Running Pulse Rate Blocking Oscillator

(1) FREE RUNNING.—When S-302 is in the X1 or X10 position the Blocking Oscillator circut operates in a free-running condition. The circuit of V-302A is shown alone in a simplified form in figure 3-6 with unused parts of the circuits removed.
The repetition rate of the pulses generated by the Blocking Oscillator is determined by the time constant of R-313 and either C-306 or C-307. The blocking oscillator covers the range from 40 to 4000 pps in two ranges. The lower range from 40 to 400 pps is obtained by switching C-306 into the circuit (X1), and the higher range from 400 to 4000 pps is obtained by switching C-307 into the circuit (X10). R-336 is included to provide more stable operation at the higher pulse repetition rates.

Note

When the Blocking Oscillator is operated in the free-running condition, the secondary winding of T-301 is placed in series with either R-316 or R-317. These 1000 ohm potentiometers are connected as variable resistors and are factory adjusted to provide pulse rate correction independently for each range.

(2) EXTERNAL POSITIVE PULSES. — When the Blocking Oscillator is to be triggered a positive pulse is required to overcome the —30V fixed bias normally applied to the grid. The circuits shown in figures 3-7, 3-8, and 3-9 are basically alike but heavy lines and arrows show the specific paths taken by the different types of externally applied synchronizing voltages. It should be noted also that SYNC SELECTOR switch (S-302) is shown throughout with the actual terminal layout for the first three positions indicated. The path followed by externally applied positive pulses is shown in figure 3-7. After this pulse is differentiated by the RC network C-303 and R-309 it is applied without change of polarity as a trigger to V-302A. The Limiting Amplifier tube V-301A is disconnected from the input terminal and V-301B is biased below cut off when switch S-302 is set to the EXT POS position.

(3) EXTERNAL NEGATIVE PULSES.—Since the Blocking Oscillator requires a positive voltage for triggering, negative pulses used to synchronize the system must first be inverted. With SYNC SELECTOR switch S-302 set to EXT NEG the incoming negative pulses are routed through V-301B (12AX7), from which they emerge as positive pulses. After differentiation by coupling across capacitor C-305 and resistor R-311 they are to be applied to the grid of V-302A through the primary winding of T-301, which is the Blocking Oscillator transformer. These circuit conditions are illustrated in figure 3-8.

(4) EXTERNAL SINE WAVES.—With switch S-302 set to the EXT SINE position both V-301A and V-301B (12AX7) are included in the active circuit. They operate as limiting or over-driven amplifiers, with rectification occurring in the plate circuit of the first section of V-301 and in the grid circuit of the second section.

It should be noted that although the circuit of V-301B is the same for both negative pulses and sine waves, grid rectification does not occur with negative input pulses. Note also that the setting of the PULSE RATE control potentiometer R-313 is not significant for any of the three EXT positions of S-302.

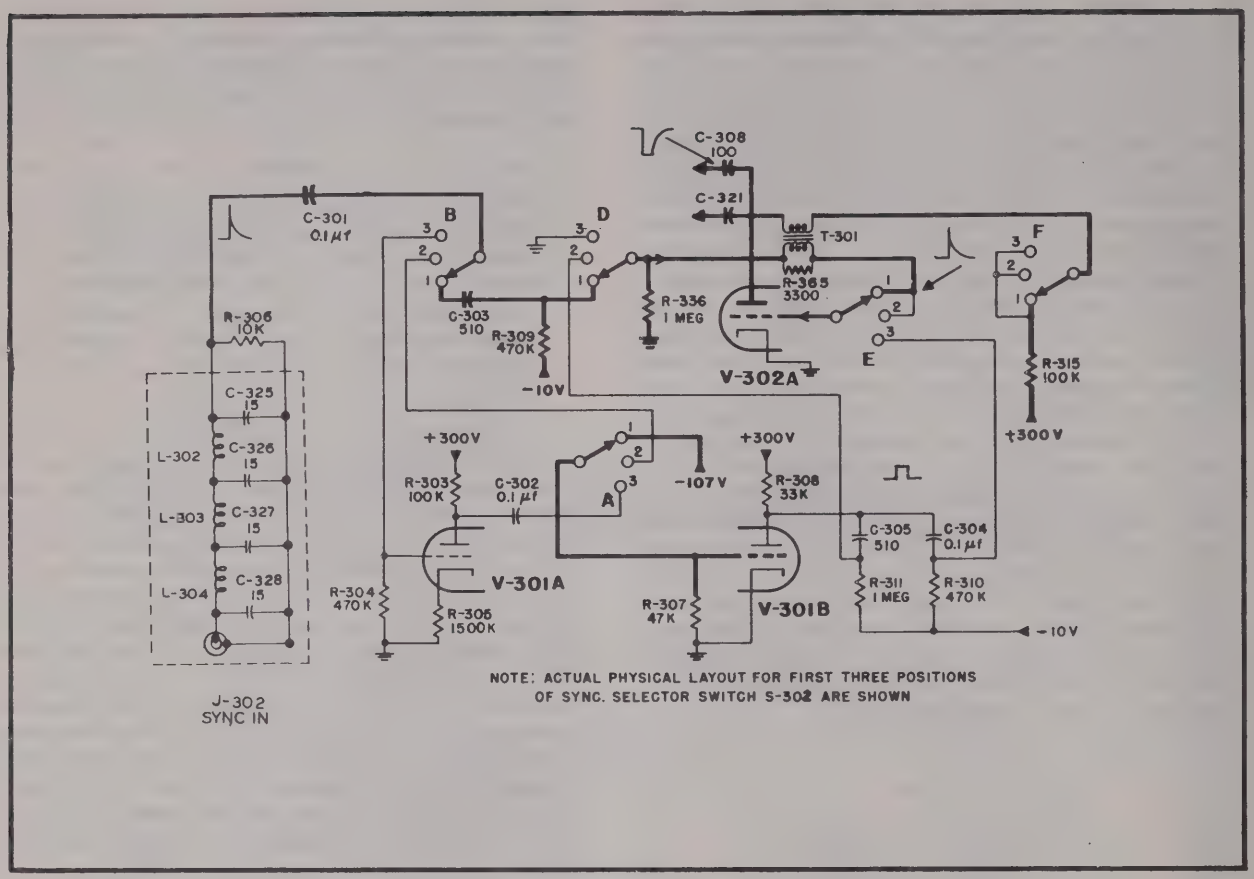


Figure 3-7. External Positive Pulse Sync Circuit

This resistor and the associated capacitors C-306 and C-307 (which with R-313 determine the time constant of the grid circuit, and thus the pulse repetition rate, of the Blocking Oscillator in the free-running condition) are disconnected by switch S-302 for all settings except X1 and X10. These overall inter-related circuit functions, which are controlled by the various settings of SYNC SELECTOR switch S-302, may be more clearly visualized from figure 7-2, Section VII. This simplified schematic shows in enlarged form the circuits of the Limiting Amplifier and the Blocking Oscillator as tied in with the various positions of this switch. It will be noted that, as in figures 3-7, 3-8, and 3-9, the actual terminal layout of switch S-302 is indicated.

The output from the Limiting Amplifier consists essentially of square waves, and these are RC coupled without differentiation to V-302A (12AT7), which for this operating condition functions as a straight amplifier. The primary of transformer T-301 is disconnected from the active circuit by switch S-302.

c. LIMITER.—Triode V-302B(6J6), shown in figure 3-10, is connected as a Series Diode Limiter between the Blocking Oscillator and the Pulse Delay circuits. The negative output pulse from the Blocking Oscillator is sharply differentiated by the coupling network C-308 and R-314, appearing at the cathode of V-302B as a sharp negative pulse resulting from the leading edge, followed by a sharp positive pulse resulting from the trailing edge of the Blocking Oscillator pulse. The series diode is connected to pass only the negative trigger pulse, forming an effective open circuit to block the positive trigger. Thus, a negative pip only is furnished as a trigger for the Delay Multivibrator, which follows the diode. The trigger occurs practically instantaneously with the external pulse when an external synchronizing pulse is applied to the instrument.

The negative pulse passed by the Limiter appears considerably altered in waveform at the plate of V-302B in the simplified schematic, figure 3-10, because of the voltage generated at the plate of V-303, which is directly coupled to the diode plate.

d. DELAY MULTIVIBRATOR. — The negative pulse passed by the Series Diode Limiter is applied as a trigger to the grid of V-303B (also shown in figure 3-10). The Delay Multivibrator, comprising both sections of V-303, is of the one-shot type, and serves to provide a time delay between the pulse obtained

from the Pulse Rate Blocking Oscillator and the pulse ultimately used to modulate the RF Oscillator.

V-303B (6J6) operates with zero bias and is thus normally conducting, while V-303A is cut-off by the cathode bias developed by V-303B. The negative trigger cuts off V-303B, allowing V-303A to conduct for a time determined by the time constant of the trigger-input circuit of V-303B. The time-constant of the latter circuit, and hence the duration of the pulse generated by the Delay Multivibrator, may be controlled over a range of 3 to 300 microseconds by resistor R-320, a potentiometer connected as a variable resistor in the grid circuit of V-303B. This control (PULSE DELAY) is directly calibrated on the front panel in microseconds of delay. Impedance Z-301, consisting of a peaking coil shunted by a flattening resistor of 3,300 ohms, is included in the grid circuit to provide adequate loading for the input to grid 5 when, with Potentimeter R-320 set for Minimum Delay, most of the resistance is out of this circuit.

The output from the Delay Multivibrator is a positive pulse at the plate of V-303B. This Delay pulse is applied to the grid of V-306 (6AG7), the Pulse Width Multivibrator.

e. SYNC OUT CIRCUITS.—In addition to the output pulse for the Delay Multivibrator, a parallel output is taken from the plate of V-302A, the Pulse Rate Blocking Oscillator, in order to produce a positive video SYNC OUT pulse. The negative pulse from V-302A is coupled to inverting amplifier tube V-303A (6J6). Coupling capacitor C-322 is of small capacitance (24 micromicrofarads) to minimize loading effects on the Blocking Oscillator. The sharpened leading edge of the positive output pulse from V-304 is applied as a trigger to Blocking Oscillator V-304B. This tube, normally biased beyond cutoff (about 16 volts negative) by voltage divider R-324 and R-323, generates a sharp positive pulse which is taken across the cathode resistor R-236 and applied as the SYNC OUT pulse to output terminal J-303. This pulse has an amplitude of about 65 volts without external load and about 45 volts when the rated load of 500 ohms shunted by 1500 micromicrofarads is used. From the simplified schematic, figure 3-11, it will be seen that the leading edge of the SYNC OUT pulse is essentially coincident with that of the original externally applied SYNC IN pulse, occurring at time t_1.

The positive Delay pulse is also used to trigger the Pulse Width Multivibrator at a time t_2, that is, a time coincident with the trailing edge of the Delay pulse. After the positive Delay pulse is differentiated in the coupling network, capacitor C-315, and resistors R-334 and R-335, a positive trigger coincident with the leading edge and a negative trigger coincident with trailing edge of the Delay pulse are applied to the grid of V-306 (6AG7) in the Pulse Width Multivibrator circuit. Because V-306 is normally conducting, it is triggered only by the negative pulse, being unaffected by the positive pulse.

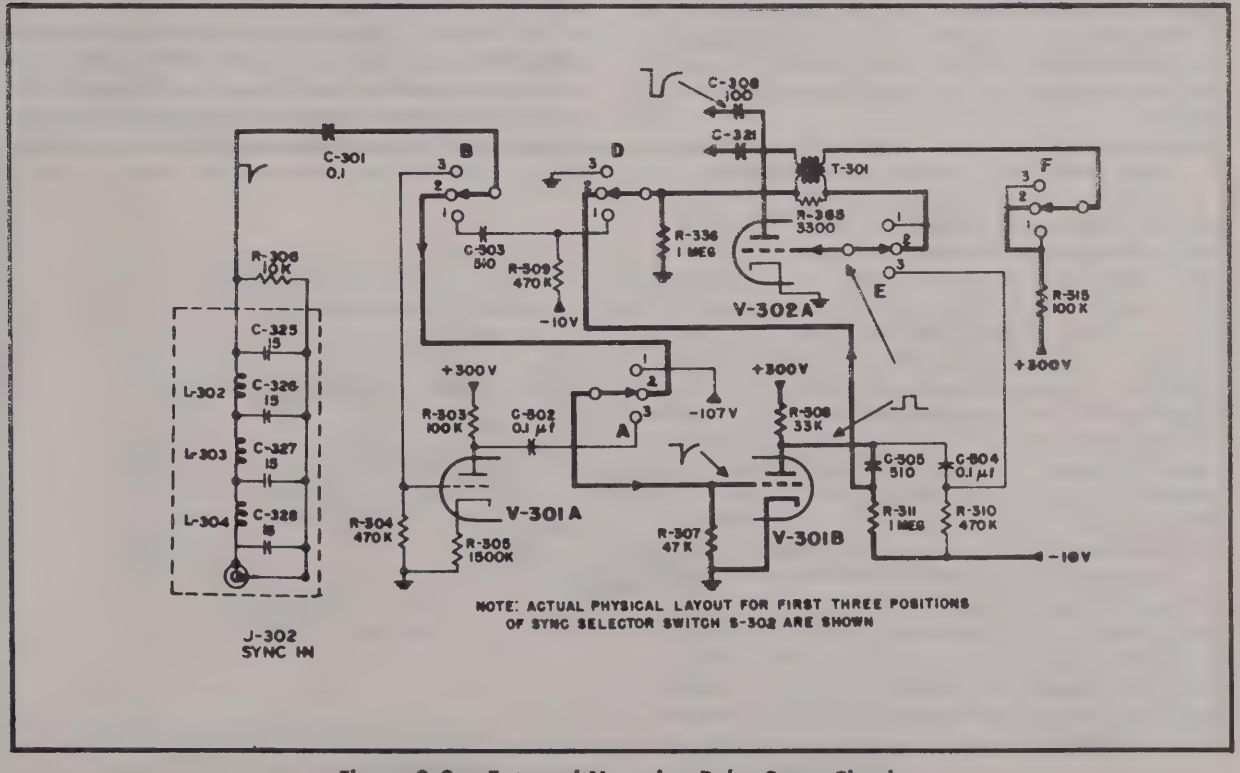


Figure 3-8. External Negative Pulse Sync Circuit

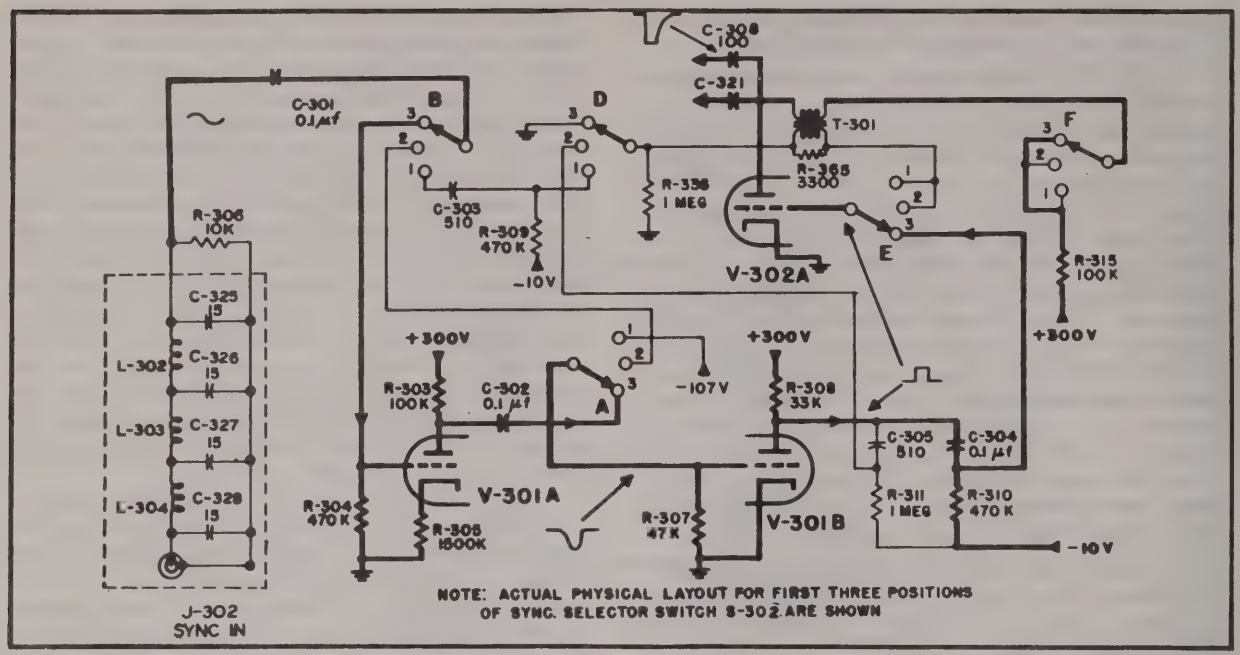


Figure 3-9. External Sine Wave Sync Circuit

f. PULSE WIDTH MULTIVIBRATOR.—From figure 3-12 it will be noted that V-306 (6AG7) acts with V-305A (6J6) as the Pulse Width Multivibrator (figure 3-12). The screen grid of V-306 serves as the plate in the multivibrator circuit, being coupled to V-305A through capacitor C-316. The function of this multivibrator is to generate a positive pulse and to apply that pulse to the grid of the RF oscillator V-201 (2C36).

For CW or amplitude modulation operation V-306 is rendered inactive by grounding its cathode, thus removing operating voltage from the plate circuit, and by disconnecting its input circuit from the rest of the system. These varied operations, which are controlled by the setting of MOD SELECTOR switch S-303, are described below, and are shown in the enlarged simplified schematic, figure 7-3, Section VII.

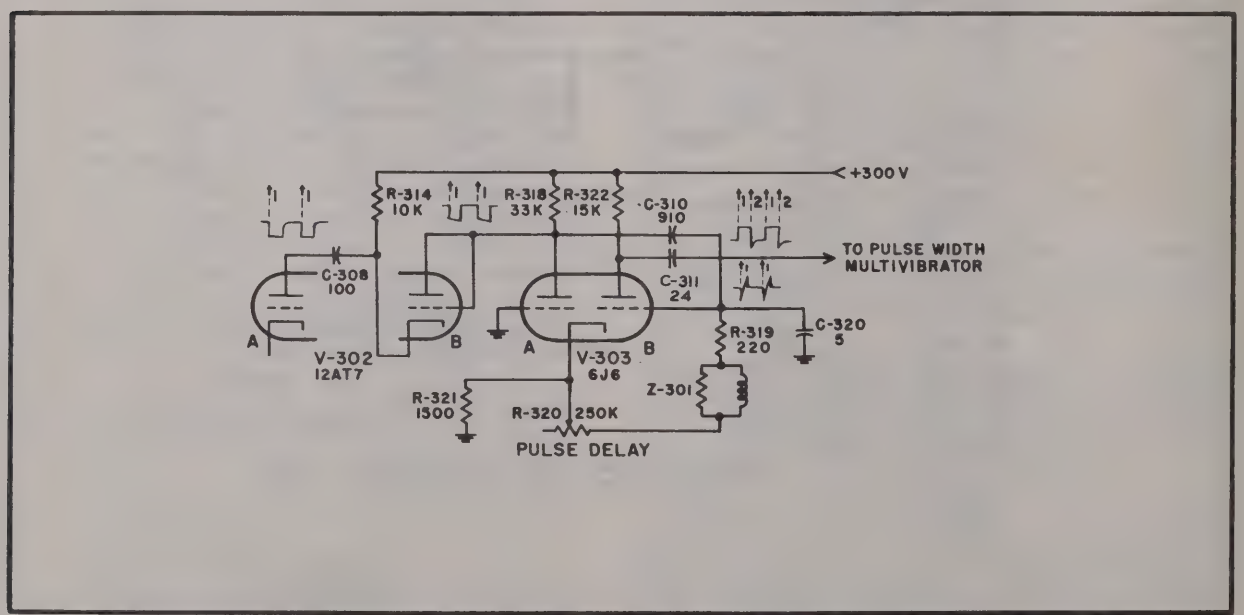


Figure 3-10. Limiter and Delay Multivibrator

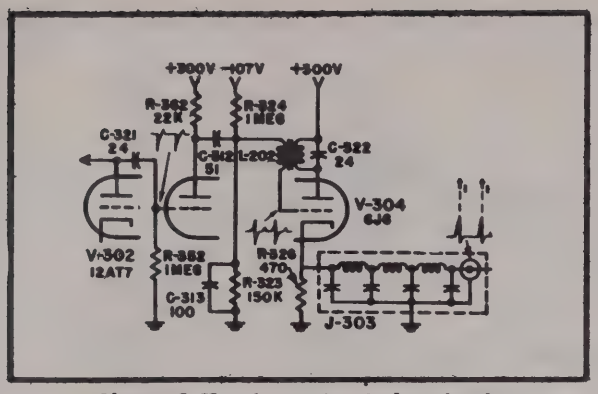


Figure 3-11. Sync Out Pulse Circuit

On internal modulation the negative trigger derived from the Delay Multivibrator output pulse is applied via switch S-303D-(2) to the grid of V-306 acting with V-305A as a one-shot multivibrator. The duration of its output pulse can be controlled by capacitor C-315 and resistors R-334 and R-335. Both are potentiometers connected as variable resistors, but only resistor R-334, the PULSE WIDTH control, may be varied from the front panel, the R-335 setting being factory adjusted for best minimum Pulse Width operation. Resistor R-334 is designed to provide a range of control from approximately 0.5 to 10 microseconds on the width of the pulse generated by the Pulse Width multivibrator.

V-306 is normally conducting with its plate potential of about 80 volts negative. As the grid of V-201 (2C36) is directly coupled between the plate load resistors R-333 and R-332, half this voltage is applied as a disabling bias to the grid of V-201. When V-306 is abruptly cut off, its plate and the grid of V-201 rise to ground potential, permitting V-201 to oscillate for the duration of the pulse.

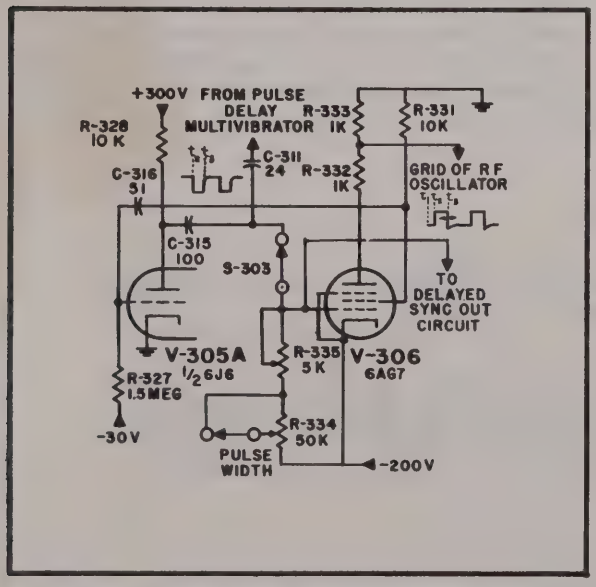


Figure 3-12. Pulse Width Multivibrator

g. DELAYED SYNC OUT CIRCUIT.—The pulses fed to the Pulse Width Multivibrator tube, V-306, are also applied thru capacitor C-318 and resistor R-366 to the grid of V-307A (6J6), an inverting amplifier. The output pulses are capacitively coupled to the grid of blocking oscillator, V-307B. These two circuits, shown in figure 3-13, are identical to the SYNC OUT circuits described in paragraph 4, c of this Section.

The output positive pulse also has identical characteristics, but its leading edge is approximately coincident with the leading edge of the pulse used to modulate the RF waves. This pulse is delivered to the DELAYED SYNC OUT terminal, J-305.

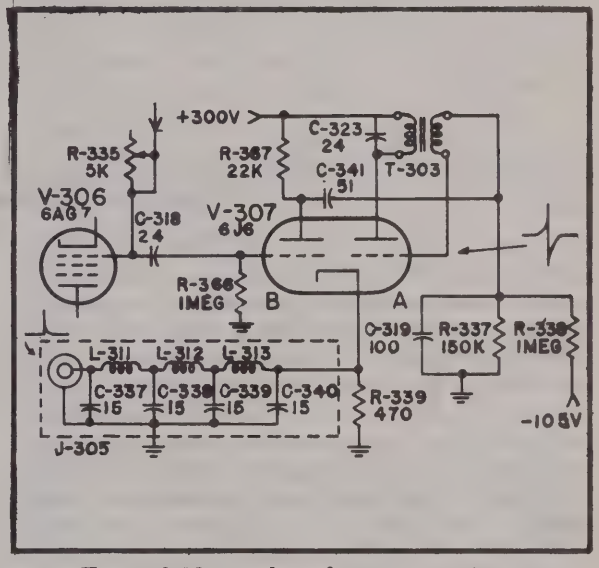


Figure 3-13. Delayed Sync Out Circuit

h. EXTERNAL MODULATION.—If the oscillator is to be modulated with an external pulse, the pulse is applied to Jack J-304, the EXT MOD jack (figure 3-14). Positive pulses are applied through switch S-303-C-(3), to the grid of V-305B, which is normally biased below cut-off. The positive pulse on the grid of this tube results in a negative pulse in the plate of V-305B (6J6) and this negative pulse is then applied to the grid of V-306 (6AG7). This tube acts as a straight amplifier, V-305A being disconnected from it by action of switch S-303-D-(3) for this operating condition. The output pulse from V-306 is applied to the grid of the RF oscillator V-201, permitting it to oscillate for the duration of the positive pulse.

When the external modulating pulse is negative, the pulse is applied without polarity inversion to the grid of V-306 through S-303-C-(4) and S-303-D-(4). Again, V-306 is permitted to act as an amplifier, disconnected by switch action from V-305A, and again its positive pulse output is used to modulate the RF energy (figure 3-15).

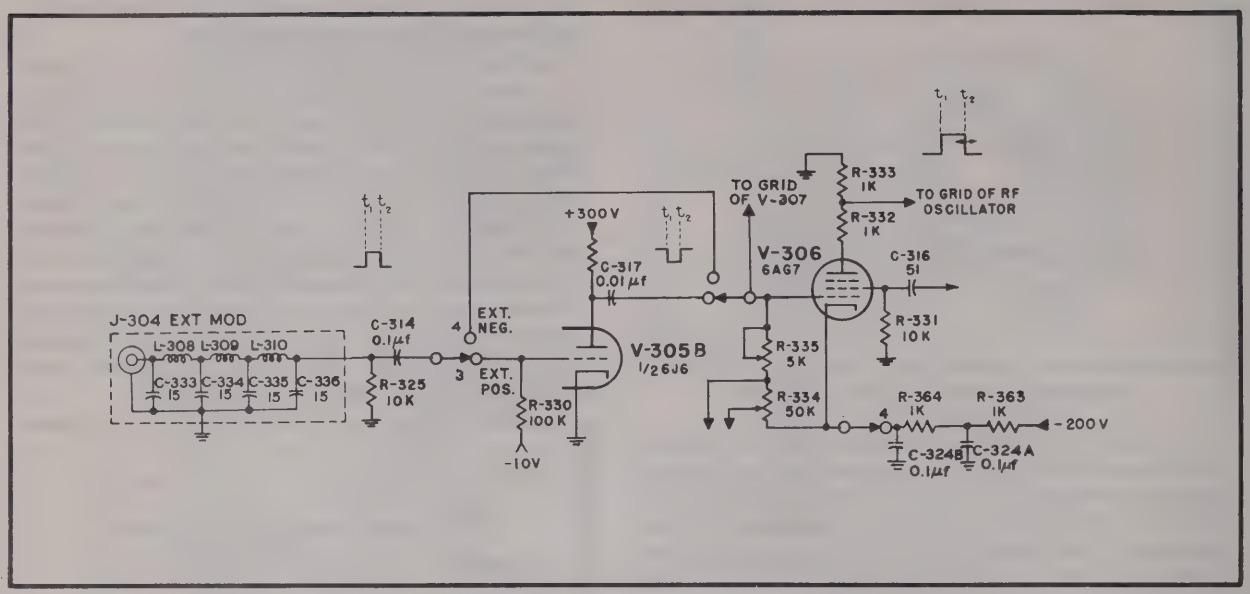


Figure 3-14. External Pulse Modulation Circuit

i. CW and AM OPERATION.—For both CW and AM operation V-306 is disabled by grounding its cathode, thus completely removing plate potential, and by disconnecting its input, as shown in figure 3-16. This allows V-201 to oscillate freely and suffices for CW operation. However, when sinusoidal voltages are applied from an external source through the EXT MOD Jack J-304, they are first amplified by V-103 and then applied to V-104, the series dropping tube in the positive voltage electronic regulator. For this operating condition, S-303A-(5) places the grid of V-105, the associated control tube, at ac ground through C-109 so V-105 cannot control the voltage level at the cathode of V-104. For this condition of operation, the sinusoidal voltages applied to the grid of V-104 are repeated in its cathode circuit and are coupled directly through an RF filter to the plate of V-201. This tube is then plate-modulated sinusoidally.

It should be noted, then, that although V-201 is grid-modulated by pulses, it is plate-modulated for AM, and simply operates at zero bias for CW.

5. MISCELLANEOUS.

The resonant cavity cannot be directly coupled to the plate of V-201 (2C36) since this would place the entire RF sub-assembly at high potential. Therefore, the plate capacitor of V-201 is coupled to the plate cylinder through C-205 of 115 mmf capacitance, formed by the tube retainer and the flange on the outer cylinder, separated by the mica ring.

Special precautions have been taken to minimize RF leakage from the instrument. For example, the

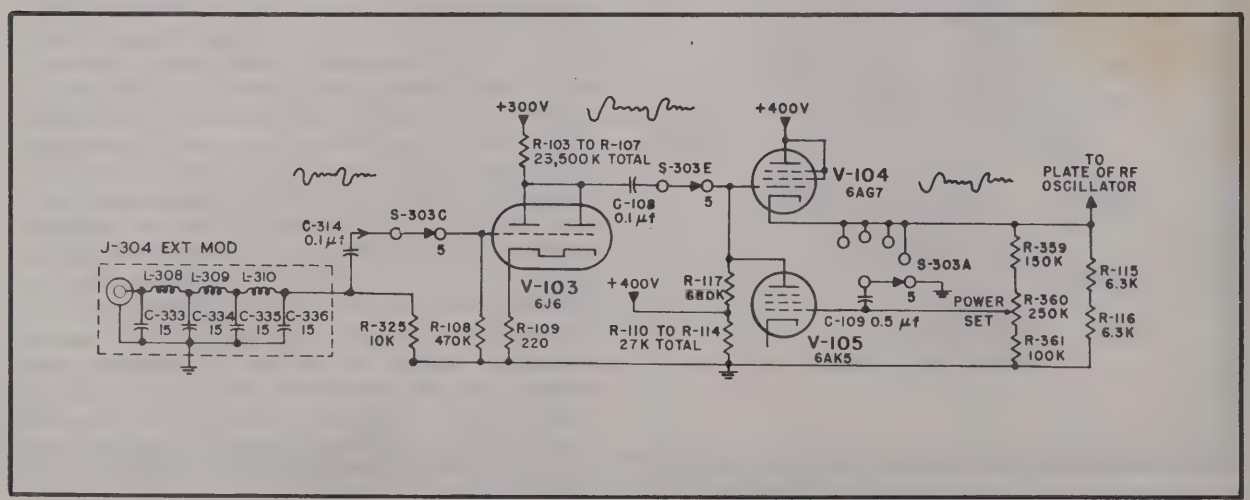


Figure 3-15. External Amplitude Modulation Circuit

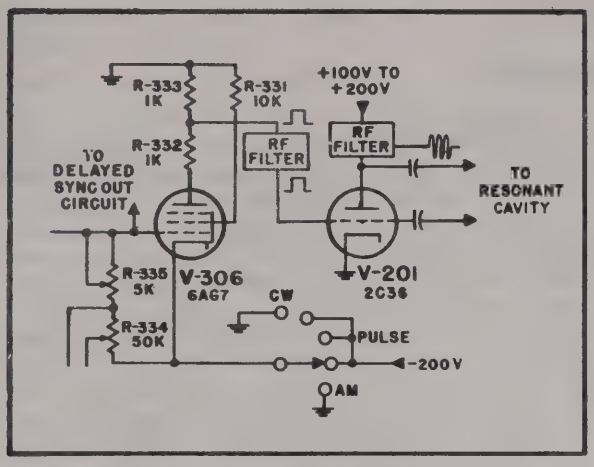


Figure 3-16. Switching Arrangement for CW, Pulse and AM Operation

plate, grid and filament leads to the oscillator tube V-201 mounted within the cavity, pass through filters designed to prevent the passage of RF energy via these paths from the cavity into the instrument case. To prevent the escape of stray RF energy in turn from the instrument case, the four front panel jacks through which synchronizing input and output signals pass, are fortified with low-pass filters, the meter is shielded by an aluminum casting, and the louvres of the instrument case are covered with wire screen. Furthermore, in Signal Generator TS-418A/U the cavity section of the RF Oscillator has been placed within a special shield equipped with additional filters for all electrical leads to the cavity, to reduce still further stray RF leakage from the cavity into the instrument case.

6. POWER SUPPLY.

The Power Supply is designed to supply +300 V for the plate circuits of all the Modulator tubes except V-306. A 200 V negative supply is provided to supply potential to the cathode of V-306 (6AG7), the plate of this tube being returned to ground through the load resistors. These voltages are all given with respect to chassis (ground). The Power Supply also provides filament power for all tubes.

The full-wave rectifier circuit associated with V-102 (5R4GY) provides a positive output voltage of approximately 400 V dc, as shown on the schematic figure 7-1. The output of the rectifier is regulated by the electronic regulator circuits associated with V-104 (6AG7) and V-105 (6AK5). The regulated positive output voltage may be varied from 100 to 200 V by the setting of resistor R-360 (PWR SET).

The stabilized 105 volt positive output from V-106 (0B2), the gaseous voltage regulator tube in the electronic regulator circuit, furnishes plate voltage for V-302B (12AT7) when it operates as a free-running blocking oscillator.

The full-wave rectifier V-102 (5R4GY) provides an output of approximately —200 V. A gaseous voltage regulator tube V-107 (0B2) is employed to furnish the stabilized bias supply, —105 V, —30 V, and —10 V taps being provided for various fixed bias applications.

Two high-powered wire-wound resistors, R-119 and R-120, are connected across the power input circuit with switch S-101 so that heat can be dissipated within the instrument case during periods of intermittent usage of the instrument.

SECTION IV

MAINTENANCE

WARNING

This equipment employs high voltages which are dangerous and may be fatal if contacted by maintenance personnel. Extreme caution should be exercised when working with the equipment. Although bleeder circuits are used, always ground any circuit before touching it.

1. GENERAL.

Signal Generator TS-418/U is an accurate test equipment, and, consequently, unnecessary repairs and attempts to make the instrument more accurate should not be undertaken, as such attempts almost invariably result in loss of accuracy. It should be borne in mind that test equipment can be tested satisfactorily only by more accurate test equipment. Such repairs as may become necessary should be undertaken only by authorized maintenance personnel who have sufficient equipment at hand so that such repairs can be made properly.

This precaution is especially true of the complex mechanical drive systems in the instrument. These drives are designed to last far beyond the life of the electrical part of the instrument and should never be tampered with unless some sort of mechanical breakdown occurs. Although an assembly procedure is included in this Section of the instruction book for reference in the event a mechanical failure occurs, mechanical readjustment should be attempted only as a last resort by authorized overhaul activities.

In making repairs on the instrument it is recommended that the test equipment listed in paragraph four of this Section be used.

In order to aid in trouble-shooting of the instrument, this Section of the instruction book contains voltage diagrams, a trouble chart, and part replacement data, as well as directions for performing electrical tests and recalibrations. In addition, Section V contains photographs that show the location of many components.

2. PREVENTIVE MAINTENANCE.

a. ROUTINE CARE.—Reasonable care in transporting, handling, and operating this signal generator will prolong its useful life and minimize the occurrence of trouble. When the instrument is not in use the power should be turned off and the power cord disconnected unless use of the heater is required on account of excessive humidity. In so far as practicable, Signal Generator TS-418/U should be protected from dust, moisture, and extremes of temperature. If it is not to be used for long periods, it should be replaced in its transit case.

b. DAILY CARE.—It is desirable to make a daily check of the exterior of the instrument. This check should be carried out as follows: After removing Signal Generator TS-418/U from the transit case, inspect the exterior for dust, dirt, and corrosion. Check the power cable for rubber deterioration, excessive wear, cuts, and kinks. Replace the cable if necessary. Give special attention to the RF and SYNC connectors. Clean these connectors and the power connector with a cloth or, if necessary, with crocus cloth. Remove grease and oil from the power cable with a soft cloth dampened with dry-cleaning solvent. Clean the meter glass. Remove grease and dust from the exterior of the dust cover and panel with a soft cloth.

c. PERIODIC INSPECTION. — Approximately once a month a more thorough inspection should be made. Remove the instrument case (as outlined in Paragraph 5 of this Section) and clean the chassis and the RF Oscillator with a soft cloth. Carefully inspect all capacitor terminals and leads for dirt, dust and the presence of moisture. Check all types of resistors for blistering, bulging, discoloration or other signs of overheating. Tighten resistor mountings if found loose. Inspect all items mounted on the terminal boards, noting any loose connections, and clean carefully with a small brush or an air blower. Examine fuse caps for evidence of burning or charring, and inspect the fuse clips for dirt, lack of proper tension, or loose connections. Check the mechanical action of all switches, and while doing so, look for signs of dirt or corrosion on all exposed elements. Tighten all loose electrical connections. In inspecting vacuum tubes, do not remove from sockets. Confine inspection to soldered socket connections, socket-mounting screws and tube clamps. Testing tubes is not advisable unless actual trouble is suspected.

Note

Do not disassemble the RF Oscillator for periodic inspection.

CAUTION

Do not tighten nuts and bolts without consideration of the strength of the material and the weight they must support. There are various degrees of pressure needed.

d. LUBRICATION.—Signal Generator TS-418/U does not require lubrication other than that given it during its manufacture. The gears in the instrument operate at low speeds and transmit negligible power. They are designed to run with only their initial lubrication; additional lubrication will accel-

erate their wear by collecting dust that acts as an abrasive.

3. TEST EQUIPMENT REQUIRED.

The following test equipment is recommended when performing maintenance work on Signal Generator TS-418/U or TS-418A/U:

a. 1000 ohms-per-volt readings:
TS-297/U Multimeter, or
Weston 663 } alternates
Simpson 443 }

b. 20,000 ohms-per-volt readings:
TS-352/U Multimeter, or
Navy "OE" }
Simpson 260 } alternates
Weston 790 }

c. Vacuum tube voltmeter:
TS-375/U, or
RCA-165 (D.C.) } alternates
Radio City 662 }

d. Oscilloscope:
TS-239/UP
TS-34/AP (Alternate)

e. Pulsed signal generator:
Hazeltine 1017

f. Bolometer bridge with an input impedance of 200 ohms and capable of measuring power with an accuracy of 0.1 of one percent over the range of 10 microwatts to one milliwatt in the frequency range from 400 to 1000 megacycles per second.

g. A receiver with a frequency range of 400 to 1000 megacycles per second and capable of producing audio output with a signal of one microvolt at the antenna connector.

h. Wave or frequency meter:
TS-127/U and 135-S, or TS-186/AP (alternate)

i. Audio oscillator:
TS-382A/U
Hewlett-Packard 200C } alternates
Hewlett-Packard 205-AC }

j. A high gain video amplifier.

k. A uhf crystal detector unit.

4. LOCALIZING TROUBLE.

The first step in correcting any trouble or failure which may occur in the instrument is to isolate the section of the circuit which is causing the trouble. Such isolation can best be accomplished by considering the circuit as composed of the basic sections shown in figures 3-1 and 3-5. Trouble ordinarily occurs in only one section at a time, so that it is usually necessary to correct only the one trouble. The Servicing Block Diagram has been prepared to aid in the isolation of trouble (figure 7-7) and if the requirements of the chart are fulfilled as regards any one section, that section of the circuit can be assumed to be operating properly. As a further aid in servicing, table 4-1 has been prepared to indicate the causes of certain possible specific troubles. In addition, figures 7-8 and 7-9 have been included to indicate the nominal values of dc voltage and resistance to ground encountered at the pins of the tube sockets in the instrument.

5. REMOVING THE INSTRUMENT CASE.

To remove the instrument case take out the two inner 10-32 screws from the bottom and loosen the eight Lion fasteners spaced around the outer edges of the front panel. These screws should be given only a quarter-turn in the counterclockwise direction. Then slide the unit out of the instrument case.

6. TUBE REPLACEMENT.

The tubes in Signal Generators TS-418/U do not generally require replacement until actual trouble develops as a result of tube failure. Faulty tube operation should be suspected if power output is insufficient, pulsing is erratic, or signal tracing discloses that the signal is present up to, but does not pass, a given tube. Tube replacement is quite simple, including that of the RF Oscillator triode V-201, which is the only tube not visible after the instrument case has been removed from the unit.

WARNING

Before pulling either V-104 or V-306 (6AG7 type) shut off power as the shells of these tubes operate at higher potential than the chassis.

a. REPLACEMENT OF V-201(2C36).—V-201, the UHF triode, is completely enclosed within the Oscillator resonant line cavity. It is not necessary to remove the Oscillator sub-assembly from the front panel to remove the tube. The location of this vacuum tube is shown in figure 4-1.

In the case of the TS-418A/U, it is first necessary to remove the outer shield cap (O-227). Take out the four mounting screws and then, with a circular motion, wring off the cap.

CAUTION

Do not pry or force the cap off with a tool, as even the slightest deformation of the tubular end of the shield will permit RF leakage. Then proceed as follows for either the TS-418/U or the TS-418A/U:

(1) Referring to figure 4-1, reach through the opening (1) in the side mounting bracket and unscrew the cavity and cap O-201 (for the TS-418A/U, use the spanner wrench conveniently mounted on the back of the cavity shield to do this).

(2) Referring to figures 4-1 and 4-2, remove resistor R-201 by unscrewing tube retainer stud H-202A on tube retainer O-203 which mounts the resistor lead.

TABLE 4-1. TROUBLE LOCALIZATION CHART

TROUBLE	POSSIBLE CAUSES	REMEDY
1. White pilot fails to light.	Main fuse may be blown.	Check a-c power source.
	Defective line cord.	Replace cord.
	Fuse blown.	Replace fuse.
	Lamp E-107 open.	Replace E-107.
	HEATER-POWER switch broken.	Replace S-101.
	R-119 and R-120 may be open.	Replace open resistors.
2. Red pilot fails to light but white light operates.	Lamp E-108 burned out.	Replace lamp.
	HEATER-POWER switch broken.	Replace S-101.
	Connector P-101 loose.	Tighten connector.
	Cable W-101 open.	Replace open wire.
	Filament line defective.	Trace and repair.
	Transformer winding open.	Replace transformer T-101.
3. Monitor meter does not zero.	RF ON-OFF switch in ON position.	Operate switch to OFF position.
	R-358 defective.	Replace potentiometer
	Monitor is out of monitor-attenuator block.	Replace and recalibrate. See par. 14, Sec.IV.
	Bead Thermistor open.	Replace. See par. 14, Sec.IV.
	VR tube V-106 not glowing.	Try new tube, V-106. Measure supply voltage, check for open circuit thru resistors (R-110—R-114 to ground).
	Open meter.	Replace meter.
	Defective resistor in thermistor bridge.	Check resistors with ohmmeter. Replace if defective.
4. No monitor output meter indication.	RF ON-OFF switch in OFF position.	Operate to ON position.
	MODULATION SELECTOR switch in PULSE position.	Operate to CW position.
	No filament voltage on V-201.	Trace filament line with ohmmeter to find open or short.
	No B voltage on plate of V-201.	Check plate filter continuity, output of regulated supply.
	Open oscillator grid line.	Locate break or replace line.
	Defective Oscillator tube.	Replace V-201 (See paragraph 6).
5. Too much RF output indication. Caution: shut off immediately if PWR SET control does not bring meter indication down.	PWR SET or ZERO SET control turned up too high.	Reset applicable control. See par. 3*b*(3) and (4), Section II.
	Defective bridge circuit component.	Check bridge circuit and associated components.
	Feedback screw not correctly adjusted.	See par. 9, b, (1) of this Section and adjust feedback screw accordingly.
	Monitor unit not out far enough.	Readjust position of monitor in guide as explained in See paragraph 14, this Section.
6. Can't reach Power Set line.	Note 2.b (a), of Section II.	Set to nearest calibration line.
	Weak Oscillator tube.	Replace V-201. See paragraph 6 a.

TABLE 4-1. TROUBLE LOCALIZATION CHART (Continued)

TROUBLE	POSSIBLE CAUSES	REMEDY
7. No RF output.	Resistor R-202 open.	Resistance from RF OUTPUT connector to ground should be 57 ohms. See paragraph 13.
	Capacitor C-206 (air-gap between E-203J and E-203K) shorted.	To test, check resistance to cavity cylinder from green lead on bottom of filter can (I-201). This should be about 1000 ohms. If C-206 is shorted it will drop to about 780 ohms. A short inside the filter will give zero reading. A milliammeter placed in grid lead (at junction of R-332 and R-333, figure 4-4) will show reversed grid current if C-206 is shorted. To remedy, remove V-201 and inject blast of air into cavity. If this fails, disassemble cavity as per paragraph 9*a*(2), (*c*) of this section and replace phenolic washers used to insulate mounting screws H-225A-D, figure 4-23.
8. Proper CW operation but no pulsed output.	MODULATION SELECTOR switch in wrong position.	Operate to PULSE.
	Pulsing circuits inoperative.	Use oscilloscope to trace for signal back to pulse generator. See paragraph 8 and fig. 7-7.
9. No DELAYED SYNC OUT but pulses at plate of V-306.	Tube V-307 defective. C-318, R-338, R-337, C-319, T-303, R-339, or filter of J-305 defective.	Try new tube. Replace defective component. Check +300 volt supply.
	No B voltage on V-307. Line from cathode to DELAYED SYNC OUT jack is defective.	Check with ohmmeter and remove cause of trouble. See fig. 7-8.
10. DELAYED SYNC OUT frequency does not agree with PRF setting.	PULSE DELAY set for more than 75% of period between pulses.	Reduce PULSE DELAY. See paragraph 2 c (2) of Section II.
	Width Multivibrator not working as one-shot multi-vibrator but as a free running multivibrator.	Bias on V-305A should be —30 volts. If not —30 volts, check —200 volt supply. Check V-107 and resistors R-344, R-345.
11. SYNC OUT pulses but no pulse at plate of V-306.	Trouble lies between C-308 and V-306.	Trace wave forms to locate defective component or tube. See Fig. 7-7.
12. No SYNC OUT pulses but pulses at Plate of V-302A.	Tube V-304 defective.	Try new tube.
	C-321, R-352, R-362, C-312, T-302, R-324, R-326 or filter of J-303 defective.	Replace defective component. Check with ohmmeter and remove source of trouble. See fig. 7-8.

TABLE 4-1. TROUBLE LOCALIZATION CHART (Continued)

TROUBLE	POSSIBLE CAUSES	REMEDY
13. PULSE DELAY calibration wrong.	Tube defective, V-303.	Replace tube. V-303 must be picked to match calibration.
	Knob has slipped.	Reset knob.
	Check R-320 for jumpy operation.	Replace pot R-320 and recalibrate. see paragraph 7,c, this Section.
14. SYNC OUT pulse will not sync. the RF output.	Pulse Delay circuit operating erratically.	Change tube V-303 (6J6)
15. PRF Calibration wrong.	Tube defective.	Replace V-302.
	Knob has slipped.	Reset knob.
	Defective variable resistor, R-313, R-316 or R-317.	Replace.
		Switch from X1 to X10. If PRF is wrong on both, check R-313. If PRF is wrong only on one setting, check Pulse Rate Correct. potentiometer affected. (R-316 or R-317). See paragraph 7,b, this Section.
16. Internal pulse operation satisfactory but cannot be externally synchronized.	MODULATION SELECTOR switch S-303 and SYNC SELECTOR switch S-302 in wrong position.	Set S-303 to PULSE and S-302 for type of synchronization used. If POS SYNC functions, but NEG SYNC does not, replace V-301. If no improvement, trace signal with oscilloscope from SYNC IN terminal to grid of V-302A for each switch position. Check that plate voltage for V-302A is +300V for EXT SYNC operations altho only +105 for INT PULSE operation.
17. Internal pulse operation satisfactory but cannot be externally pulse modulated.	MODULATION SELECTOR must be on proper polarity. Check for presence of modulating pulse at grid of V-306.	Check by signal tracing with oscilloscope from EXT MOD grid to grid of V-306. If NEG pulse sync operates satisfactorily but POS does not, replace tube V-305 and recheck.
	MODULATION SELECTOR in wrong position.	Operate to AM position.
18. No amplitude modulation.	Check continuity of wire from EXT MOD jack to grid of V-103.	Use ohmmeter and remove source of short or open circuit. (Note presence of blocking capacitor C-314.)
	V-103 tube defective.	Replace Tube.
	Components in V-103 circuit defective.	Replace components.
	Trace signal from V-103 to grid of V-104 and to plate of V-201.	Use oscilloscope to locate source of trouble. See paragraph 4 i, and figures 3-15 and 3-16 of Section III.

(3) Unscrew tube retainer O-203, using tube retainer studs H-202A and H-202C as handles.

(4) Grasp the end of tube V-201 and pull tube straight out.

(5) In replacing V-201, note that it has but one terminal pin. Exercise care to seat filament pin well in filament contact fingers before forcing tube fully into position.

(6) Reverse steps 1 to 4 above.

Owing to variations in tube characteristics it is necessary, after replacing tube V-201, to check the accuracy of calibration of the frequency dial by following the procedure given in paragraph *9b*(2) of this section. It will generally be unnecessary to readjust the setting of the feedback screw after making replacement of V-201, but should readjustment be necessary, it is vital to read paragraph *9b*(1) before attempting it.

It is also necessary to restandardize power output as outlined in paragraph *2b*(2) of Section II, and then to check the shape of the RF pulse over the entire frequency dial as described in paragraph *7d* of this section.

b. REPLACEMENT OF V-303 (6J6).—The characteristics of tube V-303 (6J6), affect the calibration of the PULSE DELAY dial. If this tube is changed it is necessary to check the accuracy of the PULSE DELAY dial, following the procedure given in paragraph *7c* of this section.

c. REPLACEMENT OF V-306.—The Pulse Width Circuit is tube-sensitive. Before replacing V-306 (6AG7) refer to paragraph *7d* of this section.

Note warning above on removing V-306.

7. ELECTRICAL ADJUSTMENTS.

a. GENERAL.—A number of internal adjustments are required in this instrument in the form of screw driver-adjusting resistors. These variable resistors have locking type bushings and before any adjustment is attempted the lock must be loosened before the shaft can be rotated. After the adjustment is made, the lock should be tightened. These screw driver-adjusting resistors have been factory set and should not be touched unless re-calibration of the control dials affected by them is called for. The procedures involved in making the calibrations required for the system are described below.

b. REPLACEMENT OF VARIABLE RESISTORS R-313, R-316 or R-317.—If any one of the three variable resistors affecting the pulse rate of the TS-418A/U is replaced or if the circuit is out of adjustment, one of the following procedures should be followed to reestablish correct calibration of the PULSE RATE dial I-303. Both procedures require the use of Oscil-

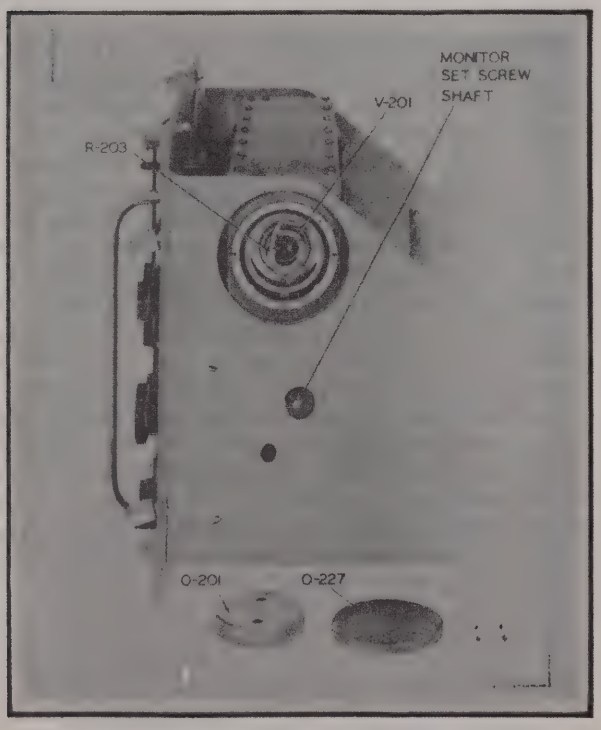


Figure 4-1. Mounting Location of Oscillator Tube V-201

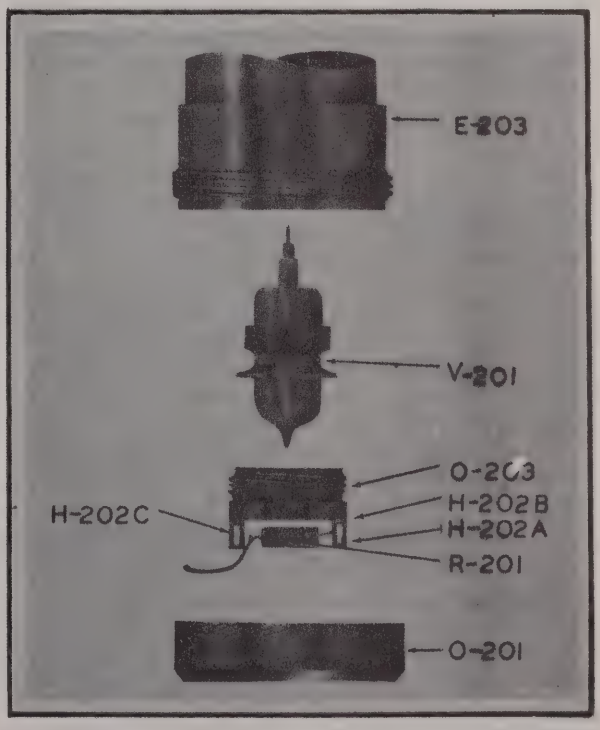


Figure 4-2. Procedure for Removing V-201

loscope TS-239/UP and Audio Oscillator TS-382A or the alternates listed in paragraph 3 of this section.

(1) Procedure 1.

(*a*) Using Video Cord W-301, connect the SYNC OUT jack on TS-418A/U through adapter UG-273/U supplied with Oscilloscope TS-239 to the EXTERNAL SYNC jack on the TS-239/U and turn the SYNC SELECTOR to HI EXT.

(*b*) Using Patching Cord CG-332/U supplied with TS-239/UP, connect the OUTPUT jack of the audio oscillator to the SIGNAL INPUT jack on the oscilloscope.

(*c*) Using second Patching Cord CG-332/U supplied with TS-239/UP, connect the second SIGNAL INPUT jack to the HORIZONTAL AMPLIFIER INPUT jack on the oscilloscope.

(*d*) Turn the SWEEP TIME—COARSE control to OFF.

(*e*) Set the SYNC SELECTOR switch on TS-418A/U to the X10 position.

(*f*) Set the PULSE RATE control on TS-418 A/U fully clockwise.

(*g*) Set the audio oscillator to 380 cycles per second.

(*h*) Turn the oscilloscope SYNC VOLTAGE control toward — (minus) and adjust the SWEEP TIME—FINE control and the HORIZONTAL GAIN control to provide a fairly large image on the screen. The pattern should consist of a vertical ellipse on the left with a pulse (line-like in appearance) breaking sharply away horizontally from it on the right.

(*i*) Adjust PULSE RATE CORRECT variable resistor R-316 (shown in figure 5-3) until the horizontal line (pulse) is stationary on the screen.

When the frequency of the sine wave (applied to the vertical plates) is identical to, or a multiple of, the repetition frequency of the pulse (applied to the horizontal plates), the screen pattern will be stationary. When the frequency of the two signals is identical, however, there will be clearly visible only a single elliptical trace with a sharp break in the wall of the vertical ellipse where it opens into the stationary pulse.

(*j*) Now, turn the SYNC SELECTOR control to X1 and set the audio oscillator to 38 cycles per second.

(*k*) Adjust variable resistor R-317 (see figure 5-3) till the screen pattern described in step (*i*) is reestablished.

(*l*) Now, change the audio oscillator output signal to 100 cycles per second and rotate the PULSE RATE control on TS-418A/U to 100. If the screen pattern called for in step (*i*) does not reappear, rotate the PULSE RATE control as required to establish the correct image. Then, loosen the set screws in the dial hub without disturbing the setting of variable resistor R-313, rotate the dial until 100 on the dial lines up with the indicator line on the front panel, and tighten the set screws.

(*m*) Check the calibration across the dial for both the X1 and the X10 settings. If the calibration accuracy is not within ±25%, recalibrate the dial at some pulse rate other than 100, following the procedure outlined above.

(2) Procedure 2.—This method also involves checking the pulse rate by means of Lissajous figures. With the audio oscillator OUTPUT jack connected to the HORIZONTAL AMPLIFIER INPUT jack of the oscilloscope, and the SYNC OUT terminal of TS-418 A/U connected to the Signal INPUT jack on the oscilloscope, check the calibration of the PULSE RATE dial as follows:

(*a*) Set the PULSE RATE control on TS-418 A/U to 100 and the SYNC SELECTOR switch to the X1 position, and turn the SYNC SELECTOR to HI EXT.

(*b*) Set the frequency of the audio oscillator sine wave to 100 precisely.

(*c*) With the above setting of the PULSE RATE control there should be a single stationary pulse on the screen. If there is not, adjust PULSE RATE CORRECT variable resistor R-317, figure 5-3, till the required pattern appears, and lock R-317 at that setting.

(*d*) Repeat the above operations with the audio oscillator output set at 1000 cps and the SYNC SELECTOR switch set to X10 (1000 cps). In this case, if further adjustment is required, adjust the setting of PULSE RATE CORRECT variable resistor R-316 until the correct screen pattern is produced.

(*e*) Check the accuracy of calibration of the PULSE RATE dial across the dial for both the X1 and X10 settings of the SYNC SELECTOR switch. If the accuracy of calibration is not within ±25%, repeat the calibration procedure outlined above at some frequencies other than 100 and 1000 cps.

(*f*) Set the audio oscillator to 400 cycles per second.

(*g*) Adjust variable resistor R-316 until there is one stationary horizontal line perpendicular to the vertical trace on the oscilloscope.

(*h*) Turn the SYNC SELECTOR to X1 and the PULSE RATE dial to 400.

(*i*) Adjust resistor R-317 until there is one stationary horizontal line perpendicular to the vertical trace on the oscilloscope.

Note

Instead of using the video pulse from the SYNC OUT jack J-303, the pulse from the RF OUTPUT jack J-201 may be employed. It is necessary to do this when the characteristics, such as the rise time, decay time, delay time or pulse width, of the RF pulse are investigated. In such case, the oscillo-

scope should be operated in the EXT SYNC position and the synchronizing voltage should be taken from the SYNC OUT jack J-303 of Signal Generator TS-418/U. The output pulse taken from the RF OUTPUT jack should be demodulated before being applied to the vertical amplifier of the oscilloscope.

c. REPLACEMENT OF RESISTOR R-319 OR VARIABLE RESISTOR R-320.—Both resistors R-319 and R-320 affect the delay time of the RF output pulse with respect to the leading edge of the initial video pulse generated in the Modulator section. When either of these components is changed, it is necessary to recalibrate the PULSE DELAY dial to determine that its calibration is within its limits. The dial is designed to be accurate within 25% or 3 micro-seconds, whichever is greater.

Note

In some cases the minimum delay may be only 3½ microseconds. If absolute accuracy is essential, minimum delay should be checked on Oscilloscope TS-239/UP as described in the dial calibration procedure below.

To calibrate the PULSE DELAY dial, measure the time interval between the start of the SYNC IN pulse and the point of 50% amplitude of the RF pulse. Connect a crystal detector between the RF output terminal of Signal Generator TS-418/U and Oscilloscope TS-239/U or equivalent using the demodulated RF in making this calibration. Set the oscilloscope GAIN to maximum and the OUTPUT ATTENUATOR to 0 in making this calibration.

Use the same sync pulse for the oscilloscope as is applied to Signal Generator TS-418/U. Then, turn the PULSE DELAY control till the pulse on the oscilloscope screen measures 100 microseconds, and lock tentatively at this setting. Now check the calibration at spaced intervals across the dial, noting point of maximum error. Reduce this maximum error as far as possible by equalizing errors over the dial, balancing a positive error at one end of the dial against a negative error at the other end.

d. REPLACEMENT OF VARIABLE RESISTORS R-334 or R-335.—If either variable resistor R-334 or R-335 are replaced it will be necessary to recalibrate the dial of the PULSE WIDTH control. The calibration of the dial is designed to be accurate within 25% for pulses greater in width than 1 microsecond, and within 0.35 microseconds for pulses 1 microsecond or less in width.

Note

Dial calibration may be slightly inaccurate for pulse widths of less than 2 microseconds. If absolute accuracy is essential, these pulse widths should be checked on Oscilloscope TS-239/UP as described in the dial calibration procedure given below.

The Pulse Width circuit is tube-sensitive, a tube of high transconductance being required to obtain the full pulse width of 10 microseconds at all output RF frequencies at a pulse rate of 4000 cps. In fact, the pulse may drop out entirely at the minimum setting. To calibrate the PULSE WIDTH dial, proceed as follows:

(1) Connect a crystal detector between the RF OUTPUT terminal of Signal Generator TS-418/U and the oscilloscope in order to demodulate the RF pulse, using TS-239/UP or equivalent in making this calibration. Use the one microsecond scope sweep and one microsecond markers. Adjust the sweep control until the illuminated scale (20 divisions) is equal to four microseconds. Turn scope multiplier to 1 and use full gain, with full RF output from Signal Generator TS-418/U. Set PULSE DELAY at minimum.

(2) Set PULSE WIDTH control to 4 microseconds. A pulse should now appear on the screen. If it fails to appear, increase the width control setting until it does. If it still fails to appear there is some other circuit trouble. If it does appear after increasing the pulse width setting, or if the pulse is too wide at the minimum setting of the PULSE WIDTH control, variable resistor R-335 requires readjustment.

(3) To readjust, loosen the locking nut on the shaft of variable resistor R-335 and rotate the control fully clockwise with a screwdriver.

(4) Set the PULSE WIDTH control fully counterclockwise.

(5) Now turn R-335 control counterclockwise until the pulse width as measured on the scope is 0.4 microsecond wide between the 50% points of the pulse amplitude. This setting should be made at the RF frequency at which the pulse width is a maximum.

(6) With variable resistor R-335 in this position, lock the locking nut on the shaft.

(7) Check pulse-width at spaced intervals over the dial, noting point of maximum error in calibration. Then reset the dial so as to equalize errors over the dial, balancing a positive error at one end against a negative error at the other, reducing the maximum error as much as possible.

e. REPLACEMENT OF VARIABLE RESISTOR R-360.—This is the PWR SET variable resistor and controls the output level of the regulated voltage supplying plate potential to V-201 (2C36). No calibration is required for this variable resistor.

f. REPLACEMENT OF VARIABLE RESISTOR R-358.—There is no calibration procedure for this variable resistor.

8. SERVICING BLOCK DIAGRAM.

Figure 7-7 is included as an aid in trouble-shooting of the instrument. The diagram shows the pulse shapes and amplitudes obtained throughout the Modulator section of the instrument when the Modulator

is synchronized with an external voltage having a frequency of 1000 cps.

It should be noted that the pulse shapes differ widely, especially in the circuits associated with the Blocking Oscillator, V-302A (12AT7) and depending on whether the Modulator is free running or synchronized with an external voltage. Therefore, when trouble-shooting in the circuits associated with V-302A, remember that a negative pulse is generated at the plate of V-302A regardless of the condition of operation, and that the leading edge of this pulse should be coincident with the leading edge of the external synchronizing voltage if one is used.

9. REPAIR OF RF SECTION.

a. MECHANICAL DISASSEMBLY AND REASSEMBLY.

(1) GENERAL.—The series of photographs in figures 4-1 to 4-28 in this section and the exploded and cutaway views in figure 7-10 of Section VII illustrate the procedures for disassembling and reassembling the various parts which make up the RF Oscillator system. These procedures are included here to show the method for disassembling and reassembling parts in case replacement of any part becomes necessary. This should be attempted only by qualified personnel at overhaul bases. The mechanical system is complex and mechanical skill and ingenuity are required to repair the system. Although complete disassembly procedure is included, it is intended that only applicable portions should be followed when making repairs or replacements.

Owing to the presence of the cavity shield and attached filters in the TS-418A/U, the disassembly procedure is not entirely the same for the TS-418A/U and the TS-418/U RF oscillator systems. The complete procedure for the TS-418A/U is given in paragraph 9*a*(2), while the TS-418/U procedure which differs from that for the TS-418A/U is given in paragraph 9*a*(4). Where the procedure for the TS-418/U is the same as that for the TS-418A/U, reference is made from paragraph 9*a*(4) to the applicable portions of paragraph 9*a*(2).

CAUTION

Many of the parts in the mechanical system are machined to critical tolerances. Therefore, no attempt should be made to force parts together. Make certain that parts are being assembled properly and that all moving parts run without binds or misalignment.

(2) TS-418A/U RF OSCILLATOR DISASSEMBLY.—Some minor maintenance work may be done on the RF Oscillator subassembly without removing it from the front panel of the instrument and without taking the cavity out of the shield. Thus it is possible to replace the UHF triode V-201 (2036) as described in paragraph 6*a* of this section. It is also possible to remove the end shield O-226, figure 4-4, in order to adjust the setting of the monitor unit E-203B for purposes of recalibration or to replace it, or to test continuity of or replace filters Z-203 or Z-201. By removing the end cap O-228, figure 4-8, from the shield, it is possible to take off the cavity end housing A-201 in order to check the carriage drive mechanism or check the continuity of filters Z-202, Z-205, and Z-206. To gain access to the freqency dial stop items, figure 4-8, it is necesary only to remove the shield top cover A-205, while the attenuator dial stop parts are accessible from below the chassis, as seen in figure 4-4, without any disassembly whatever. More extensive disassembly, however; calls for removal of the RF Oscillator subassembly from the front panel of the instrument.

(*a*) REMOVAL OF OSCILLATOR SUBASSEMBLY FROM THE FRONT PANEL.—In order to disasemble the RF Oscillator subassembly it is necessary to remove it from its position on the front panel of the instrument as illustrated in figure 4-24. Figure 4-4, a sectional sub-chassis view, indicates leads that must be unsoldered to permit removing the Oscillator sub-assembly from the instrument. Unsolder the short outer brown lead from the terminal on lamp I-102 (E-108 on Wiring Diagram, figure 7-3).

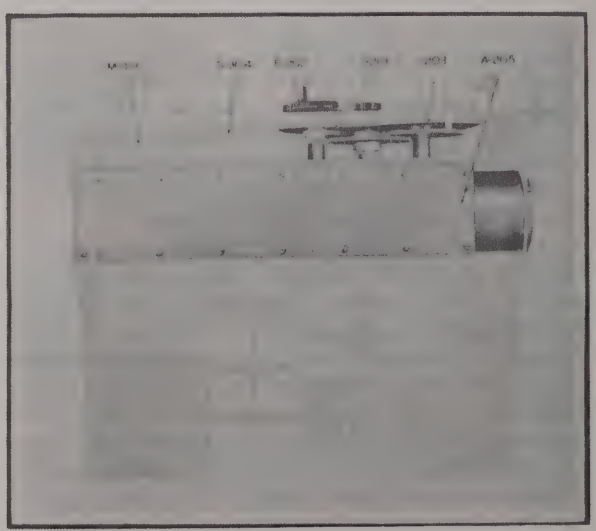


Figure 4-3. Signal Generator TS-418A/U, Oscillator Sub-assembly Mounted on Front Panel

Note

Do not unsolder this lead from filter Z-206.

Then unsolder the long outer white lead from standoff insulator E-204 on the cavity shield adjacent to filter Z-203. The location of these items is clearly shown in figure 4-11. Remove the yellow-red, the

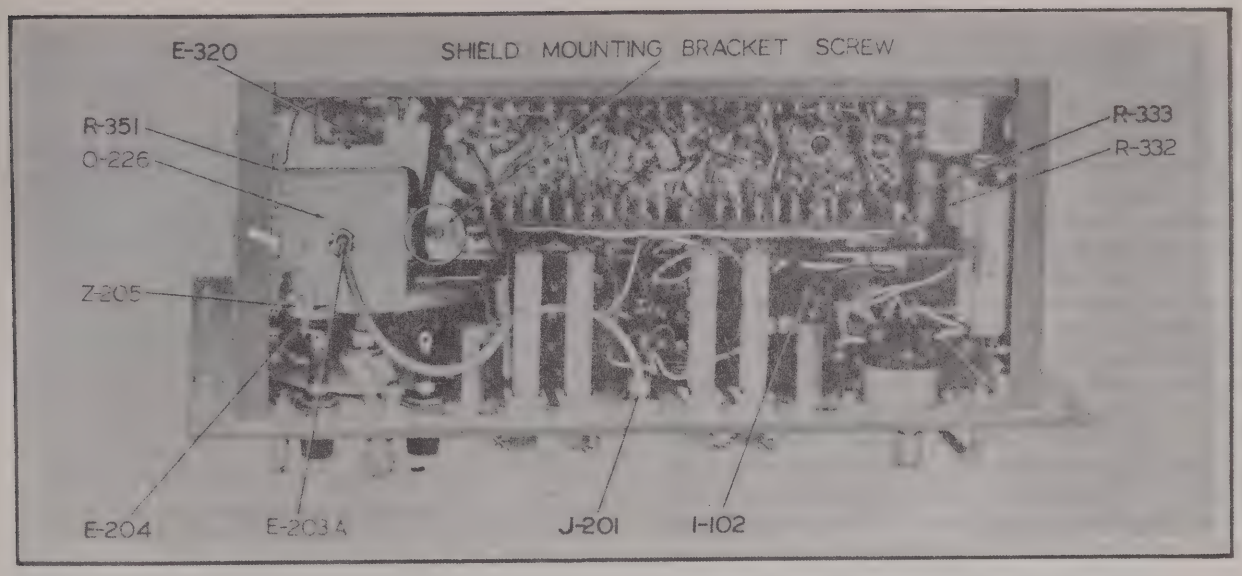


Figure 4-4. Signal Generators TS-418/U and TS-418A/U, Sub-chassis Disassembly for Removing Oscillator Sub-assembly

green-black, and the blue leads from terminals 1, 2, and 3 respectively, on the small terminal board E-320, figure 4-4. Take out the bracket mounting screw (shown encircled in figure 4-4) from the supporting bracket. This bracket is shown in figures 4-7 and 4-11. Then remove jack J-201 from the rear of the front panel by taking out its four mounting screws.

Figure 4-5 indicates those controls and screws which must be loosened or removed in order to free the Oscillator subassembly from the front panel. Loosen the eight panel mounting screws spaced along the band guard rails as far as possible without taking them out. Remove drive knobs E-201 and E-202 and PULSE RATE dial I-303. Unscrew the locking nut adjacent to the dial LOCK below frequency dial I-203 and that adjacent to the dial LOCK below knob E-201.

Figure 4-6 shows the six studs on the sub-panel and figure 4-5 shows the six screws which lock the front panel to them. Remove these screws and then lift the Oscillator subassembly carefully from the unit.

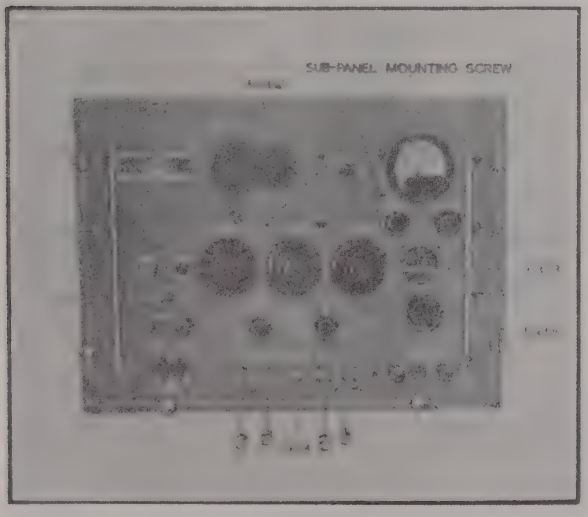


Figure 4-5. Signal Generators TS-418/U and TS-418A/U, Front Panel Disassembly for Removing Oscillator Sub-assembly

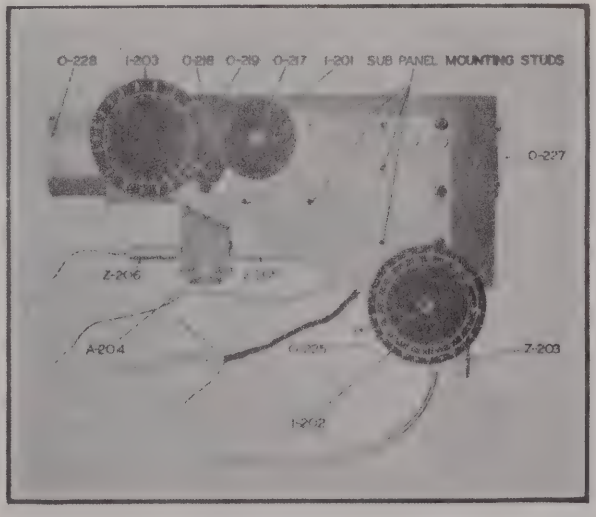


Figure 4-6. Signal Generator TS-418A/U, Front View of Oscillator Sub-assembly

(*b*) REMOVAL OF CAVITY FROM SHIELD AND SUB-PANEL.—Figures 4-6 and 4-7 furnish front and rear views, respectively, of the Oscillator subassembly after separation from the front panel. Referring to figure 4-7, loosen nut H-209 and remove feedback screw H-208. Then, referring to figure 4-6, take off vernier frequency dial I-201 by loosening the set screws in its hub. The dial lock (clamp) may then be slid off the dial hub, if desired. Referring to figure 4-3, take out the 17 4-40 binder head screws spaced around the edges of shield cover A-205 and lift it off. Figure 4-8, a top view of the subassembly with the shield cover A-205 off, shows the dial stop mechanism associated with the two frequency dials. Loosen locking screw H-229 in cam O-215 and lift cam off dial shaft. Then lift out main frequency dial shaft with permanently attached anti-back-lash gear and dial I-203. Slide cam O-216 from vernier dial shaft O-217 after loosening locking screw H-230. Now lift out vernier shaft O-217 with permanently attached spur gear, shown in place in figure 4-9.

Referring again to figure 4-6, unscrew the retaining nut from drive shaft O-212 and take off dial drive spur gear O-218. After loosening the two set screws in its hub, slide anti-back-lash gear O-219 off shaft O-212 also. This shaft with both gears removed is shown in figure 4-9. The entire frequency gear train and dial stop mechanism are also shown in figure 4-28. Although this view is of the TS-418/U, the construction is identical except for the absence of shield housing A-206 between the sub-panel and cavity support block A-203.

Note

When reassembling these gears, set them to eliminate back-lash.

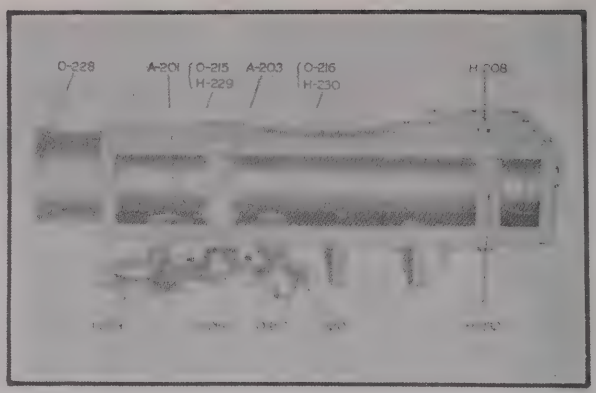


Figure 4-8. Signal Generator TS-418A/U, Top View of Oscillator Sub-assembly with Shield Cover Removed

Referring to figures 4-9 and 4-4, take out the eight 4-40 binder head screws spaced around the outer edges of end shield O-226, and remove end shield carefully so as not to damage the grounding fingers spaced around the attenuator E-203A. Figure 4-10 shows the attenuator grounding fingers on O-226 after its removal, while figure 4-11 shows the attenuator (probe) E-203B in position in the attenuator block. To remove end shield O-226 from the attenuator cable without damaging any parts, unscrew the nut from jack J-201, pull jack off cable, and slide end shield O-226 over cable.

Now take off twin filter shield cover A-204 shown in figure 4-9 by drawing out the eight binder head mounting screws. Remove the screws from shield caps O-227 and O-228 shown in figure 4-9 and with a circular motion, wring off caps.

Figure 4-7. Signal Generator TS-418A/U, Rear View of Oscillator Sub-assembly

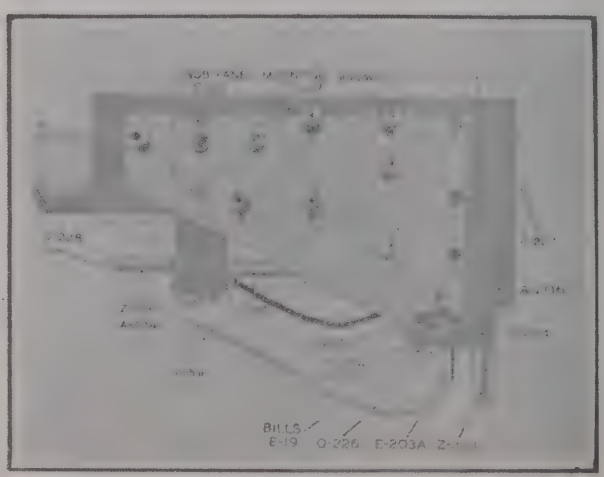


Figure 4-9. Signal Generator TS-418A/U, Front View of Oscillator Sub-assembly with Dials and Gear Train Removed

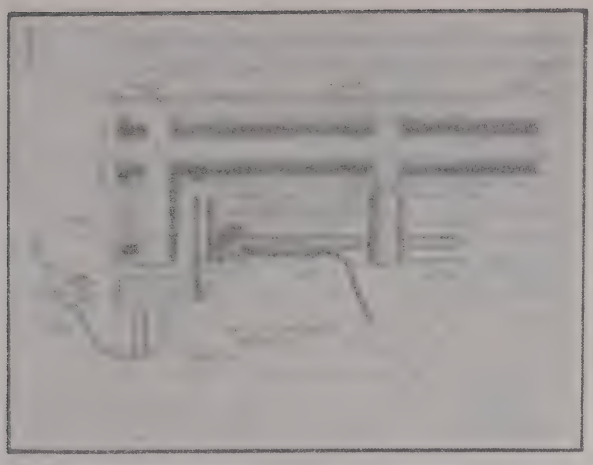


Figure 4-10. Signal Generator TS-418A/U, Rear View of Oscillator Sub-assembly with Side of Shield Removed

CAUTION

Do not pry up or force off caps with tools as the slightest deformation of caps or shield will permit RF leakage during operation of the instrument.

Extract the 21 number 4-40 binder head screws spaced irregularly around the edges of shield housing A-207, and lift off this section of the shield. Figure 4-10 shows the assembly with housing A-207 off. Then unsolder the green (grid) and brown (filament) leads from their terminals on the bottom of twin filter Z-202, figure 4-10. Referring to figure 4-11, unsolder the monitor lead from the adjacent standoff insulator E-205 and the white lead from the terminal on plate filter Z-201. Then loosen the set screws in the hub of attenuator dial I-202 shown in figures 4-6 and 4-11 and slide dial off shaft O-225. If desired, the dial lock (clamp) may then be removed. Loosen locking nut H-231 and slide dial stop arm O-224 from shaft O-225, shown in figures 4-9 and 4-11.

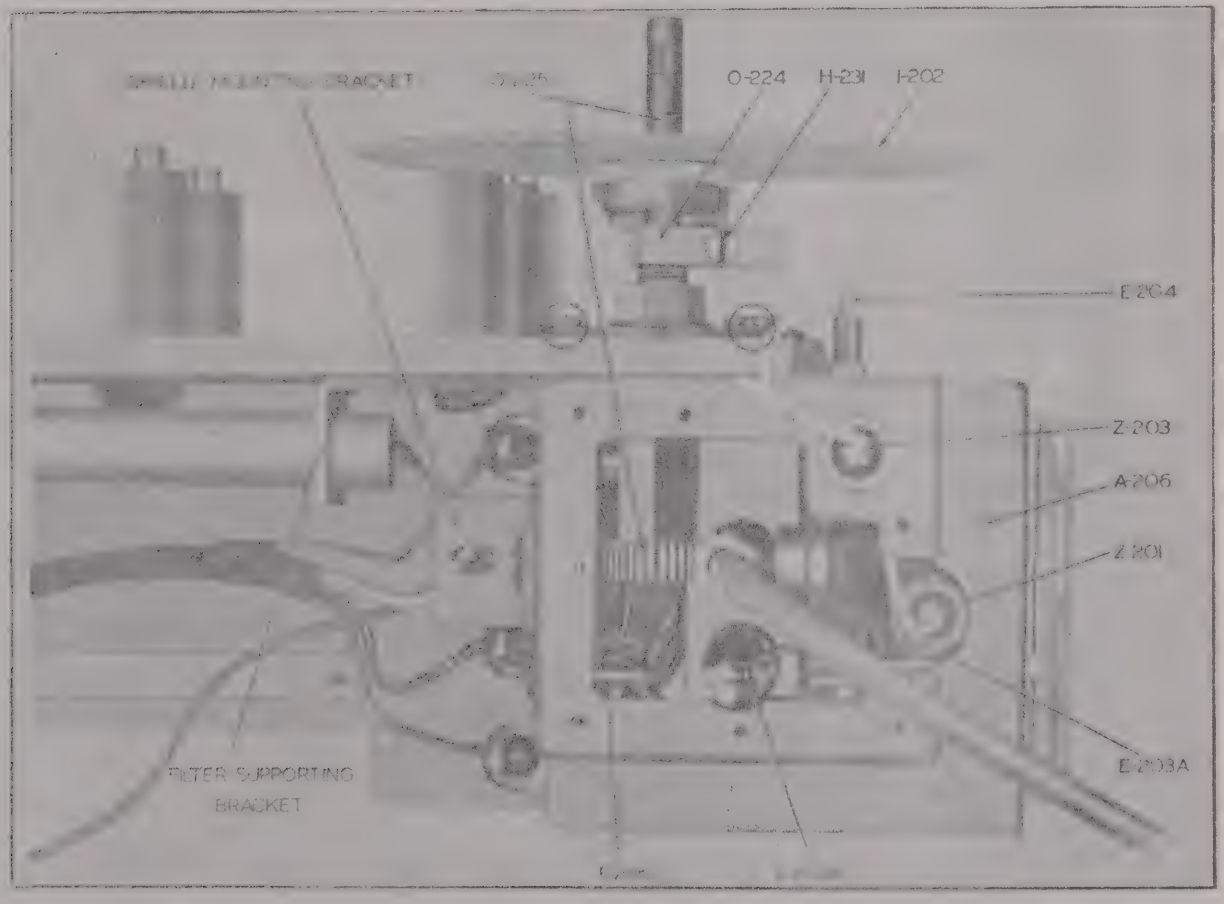


Figure 4-11. Signal Generator TS-418A/U, Sectional Bottom View of Oscillator Sub-assembly with End Shield Removed

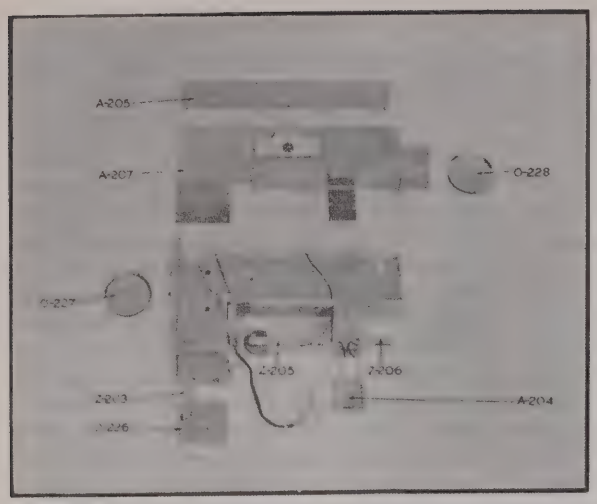


Figure 4-12. Signal Generator TS-418A/U, Oscillator Sub-assembly Shield Components

Take out the two 4-40 binder head screws which mount the centering plate for the dial shaft and hex stud bushing, unscrew the heavy retaining nut from the stud bushing, and lift shaft and bushing out through the open side of the shield.

In reassembling, the stud bushing retaining nut must be screwed on tight and the dial stop arm O-224 set to hold the attenuator drive gear well against the stud bushing in order to avoid end play of the shaft and dial wobble. Because of the oversized screw holes in the centering plate, when loosened, the centering plate may be moved so as to help adjust the position of the attenuator E-203A within the circular wave guide in the attenuator block.

Referring to figure 4-10, remove the two mounting screws (shown encircled) in the support bracket for filter Z-205. Then take out the five heavy hex-nut mounting screws from the sub-panel shown in figure 4-9, and lift off the sub-panel. Handling the sub-assembly carefully now, as the cavity is loose in shield housing A-206, lift the cavity out sufficiently

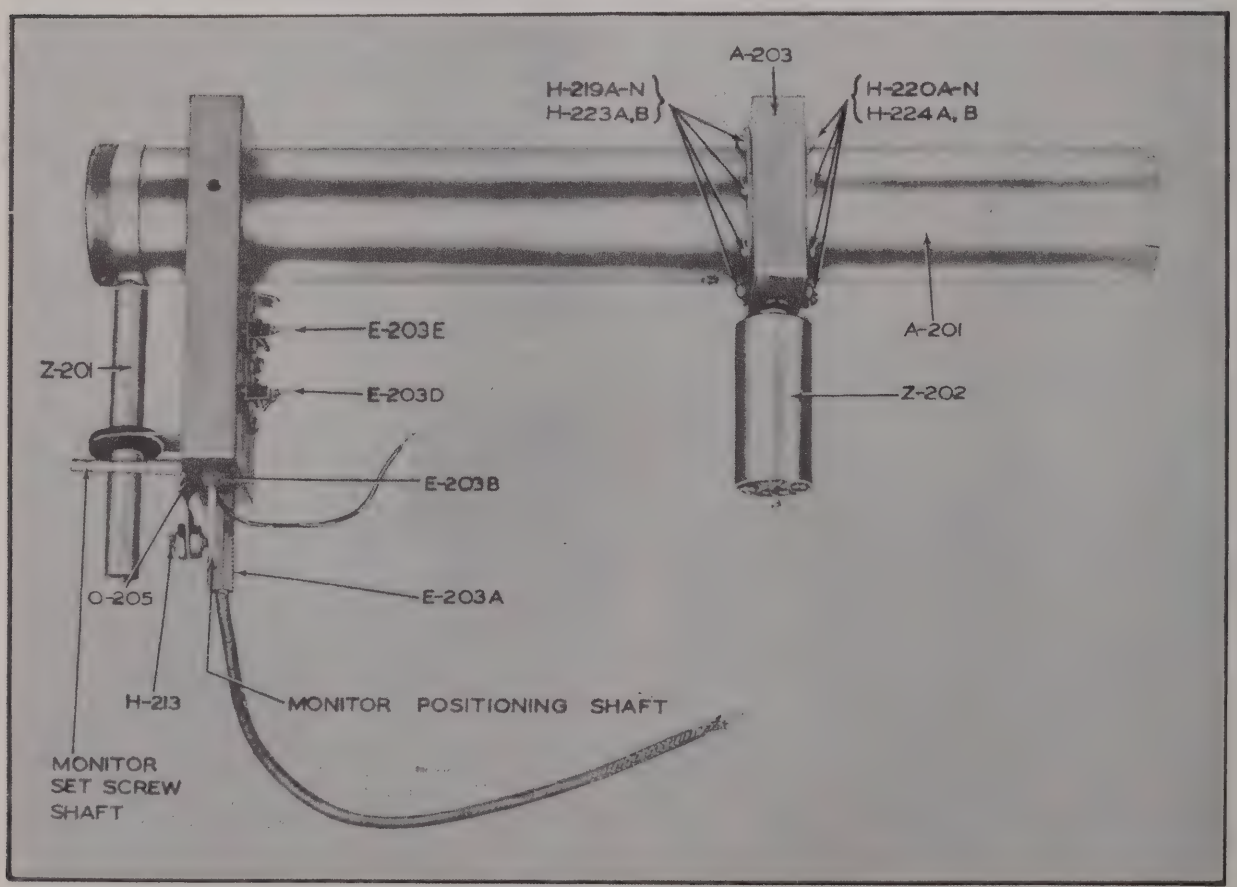


Figure 4-13. Signal Generator TS-418A/U, Oscillator Sub-assembly with RF Shield Removed

to expose the disc thermistor standoff insulators E-203D and E-203E mounted on the attenuator block as shown in figure 4-10. Referring to figure 4-18, an enlarged face view of the attenuator block showing the disc thermistors and associated standoff insulators, unsolder the yellow-red lead from the lug on R-349, the blue lead from insulator E-203D, and the green-black lead from insulator E-203E. Now guide the cavity out of shield housing A-206. Figure 4-13 shows the cavity after removal from the shield, and figure 4-12 shows the components of the shield with filters still in place. The filters may easily be detached by unscrewing them.

(*c*) DISASSEMBLY OF CAVITY.—The first step in disassembling the oscillator unit itself is to remove V-201, the UHF triode 2C36, the procedure for which was given in paragraph *6a* of this section. Figures 4-1 and 4-27 show V-201 seated in the cylinder and the mounting connections of resistor R-201 to the tube retainer stud H-202A. The disassembly sequence is indicated in figures 4-2 and 7-10. Next, unscrew the plate filter Z-201 from the plate cylinder. Referring to figure 4-13, draw the attenuator unit E-203A out of the attenuator block. Then take out the set screw shaft which locks the monitor unit E-203B in position in the attenuator block, and withdraw the monitor.

The dial stop items should be taken out next to avoid damaging any of these parts. They are shown in position on the cavity support block A-203 in figure 4-14. Loosen the set screw in the end of the dial stop arm O-208 and remove the dial stop pin from the support block. Then remove screws and lockwashers H-216A-D which secure dial stop spring O-207 to the support block and lift off arm and attached spring as well as the small mounting spacer as shown in figures 4-15 and 4-19. Spring O-207, may, in turn, be removed from the dial stop arm O-208 by withdrawing two screws and associated lockwashers H-215A-D. Turning again to figure 4-13, remove the seven 5/16 inch screws and lockwashers H-220A-N and the 3/16

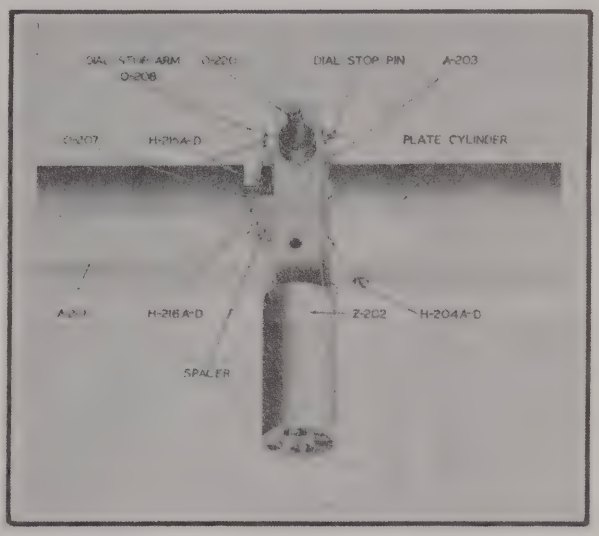


Figure 4-14. Dial Stop Parts in Place on Cavity Support Block

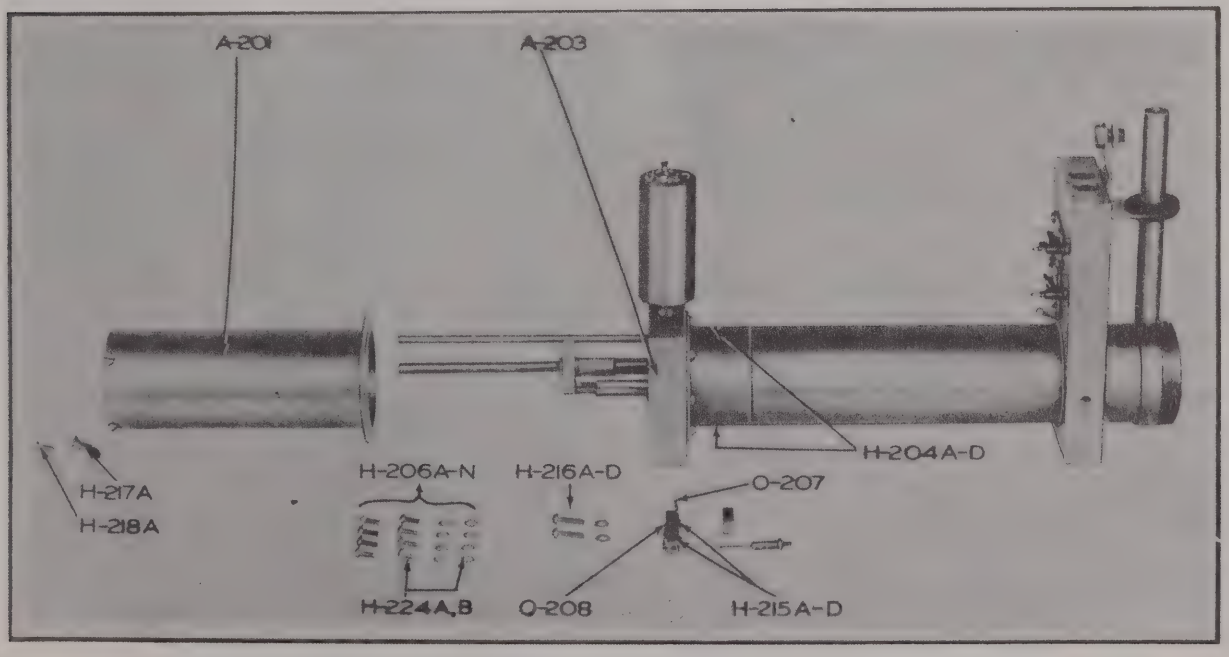


Figure 4-15. End Housing and Dial Stop Arm Detached From Cavity Support Block

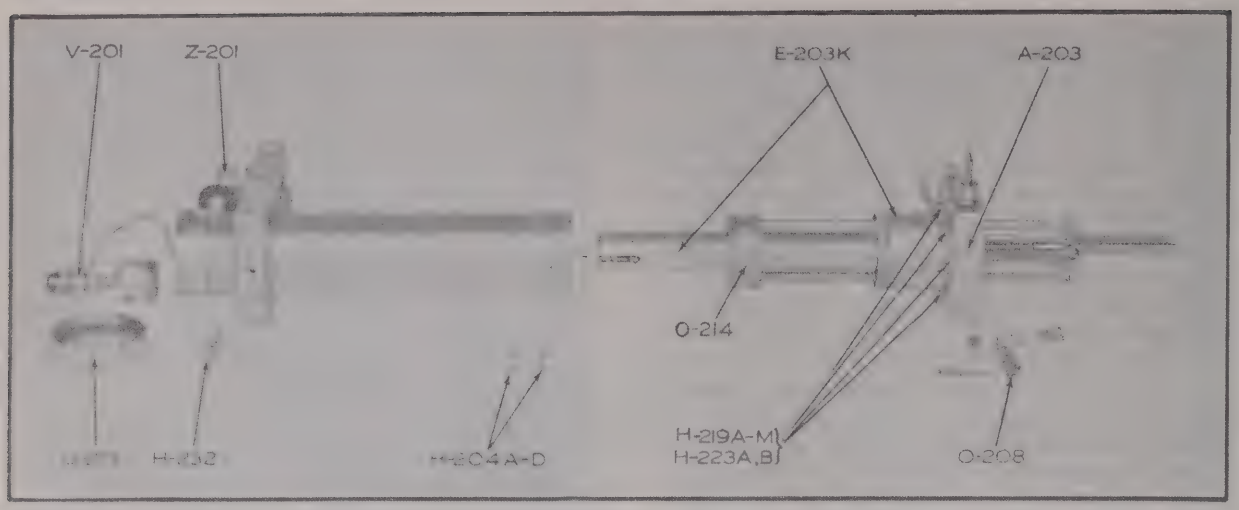


Figure 4-16. Plate Cylinder Separated from Grid Cylinder Section of Cavity

inch screw and lockwasher H-224A-B which mount the cavity end housing A-201 to the support block A-203. On reassembling, note that the 3/16 inch screw H-224 stands adjacent to twin filter Z-202. After extracting the two screws H-217A and H-218A shown in figures 4-15 and 7-10, lift off the end housing.

After taking out the tuning screw H-232, which is shown in place in the attenuator block in figures 4-10 and 4-17, remove the two mounting screws and lockwashers H-204A-D which secure the plate (outer) cylinder in position as indicated in figures 4-14 and 4-15. The plate cylinder, which is permanently attached to the attenuator block, is now free of the grid cylinder retainer E-203K, illustrated in figure 4-16. Pull the plate cylinder gently from the rest of the unit, exercising care to prevent damage to the fingers of the plate brush O-214. The plate cylinder and grid cylinder sections are shown after separation, in figure 4-16.

Referring to figure 4-17 while further disassembling the plate cylinder, remove the attenuator shaft guide O-205 with adjustment screw H-213 by removing mounting screws and lockwashers H-211A-D. Mounting details are shown in figures 4-27 and 7-10. Referring again to figure 4-17, reach down into the plate cylinder with a long-bladed screwdriver and take out the four mounting screws H-214A-D the teflon disc insulator E-203G, the tube retainer O-206 and four associated phenolic bushings, and the mica disc insulator E-203H, which constitutes the dielectric for capacitor C-205. Figure 4-18 pictures these items after removal from the plate cylinder. To demount the disc thermistors R-349 and R-355 from the attenuator block, remove the screws and washers, while referring again to figure 4-17. Note, however, in reassembling them that R-355 is placed with its mounting plate (negative terminal) grounded directly to the attenuator block, while R-349 is insulated from ground. Insert mica plate insulator E-203C between the attenuator block and the mounting plate and the negative terminal lug of R-349. The mounting screws H-203A, C, E, G are insulated from the thermistor plate by means of phenolic bushings O-204 A-D, no metal washers being used.

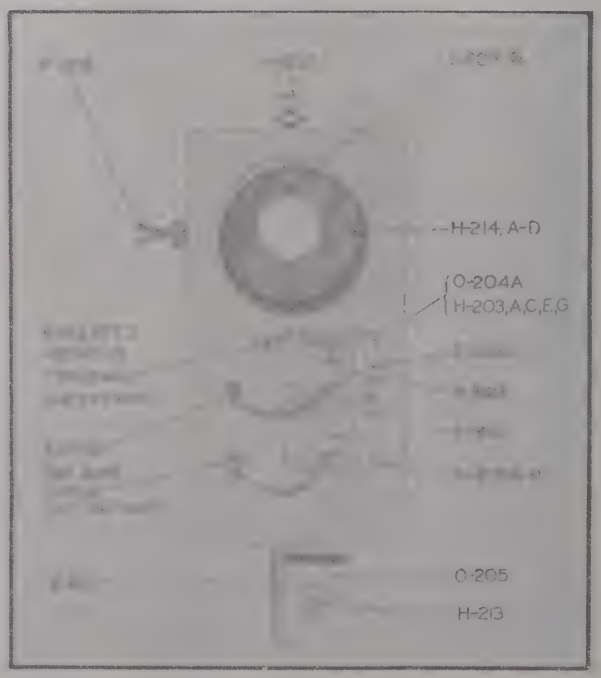


Figure 4-17. Attenuator Block with Disc Thermistors in Place

Figure 4-19 shows the grid cylinder section of the cavity with carriage drive and associated items in place. Remove screws and lockwashers H-212A, B and H-207A-H to release the axial gear rack and the four push rods from carriage drive block O-210, and slide the drive block off the cavity carriage shaft O-211. Now unscrew carriage shaft O-211 and guide rail A-202. Rotate the pinion gear on the drive shaft O-220 until the rack gear O-209 clears the assembly and lift rack gear out. After unsoldering all leads from the two lugs on the standoff insulator indicated in figure 4-19, unscrew twin filter Z-202 from the cavity support block A-203.

Note

In reassembly, note that the brown lead from Z-202 and the filament lead from the cathode cylinder O-212 are soldered to the outer lug on the standoff insulator, and that the green lead from Z-202 and the other lead emerging from the carriage support guide are soldered to the inner lug. The two leads emerging from openings in the carriage support guide (which is permanently attached to the cathode cylinder O-212) are indicated in figures 4-20 and 7-10.

Referring to figure 4-16, remove the seven 5/16 inch screws and lockwashers H-219A-M and the 3/16 inch screw and lockwasher H-223A, B which mount the grid cylinder retainer (and permanently attached grid cylinder) E-203K to the cavity support block A-203 and lift the support block from the assembly. Figure 4-20 shows the grid cylinder section thus disassembled and figure 4-21 shows the cavity support block A-203 after removal from the grid cylinder retainer.

Figures 4-19 and 4-21 show reverse sides of the cavity support block A-203. To disassemble the support block, loosen the two set screws in the dial shaft collar and the three which lock the sleeve bearing O-223 in the support block. Slide the collar off the dial shaft O-220 and pull the sleeve bearing along with dial shaft and permanently affixed spur gear into the cavity opening in the support block and lift them out. Then demount the flat guide spring O-221 and associated spacer plate O-222 from the sleeve bearing O-220 by removing the mounting screws and lockwashers H-227A-D.

Referring to figure 4-20, remove screws and lockwashers H-221A, B and H-222A, B, to free the carriage guide plate O-212 from the grid cylinder retainer E-203K. It is not necessary to take out the screw which mounts the standoff insulator; however,

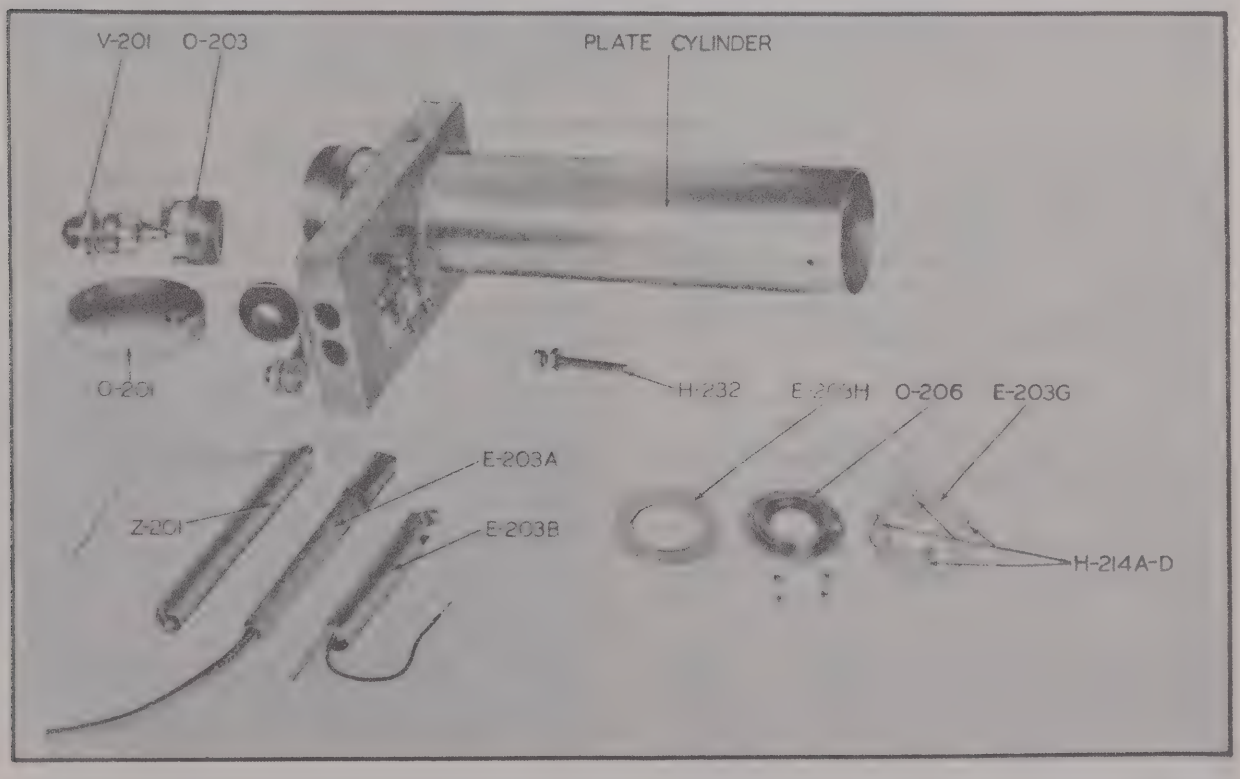


Figure 4-18. Disassembly of Plate Cylinder

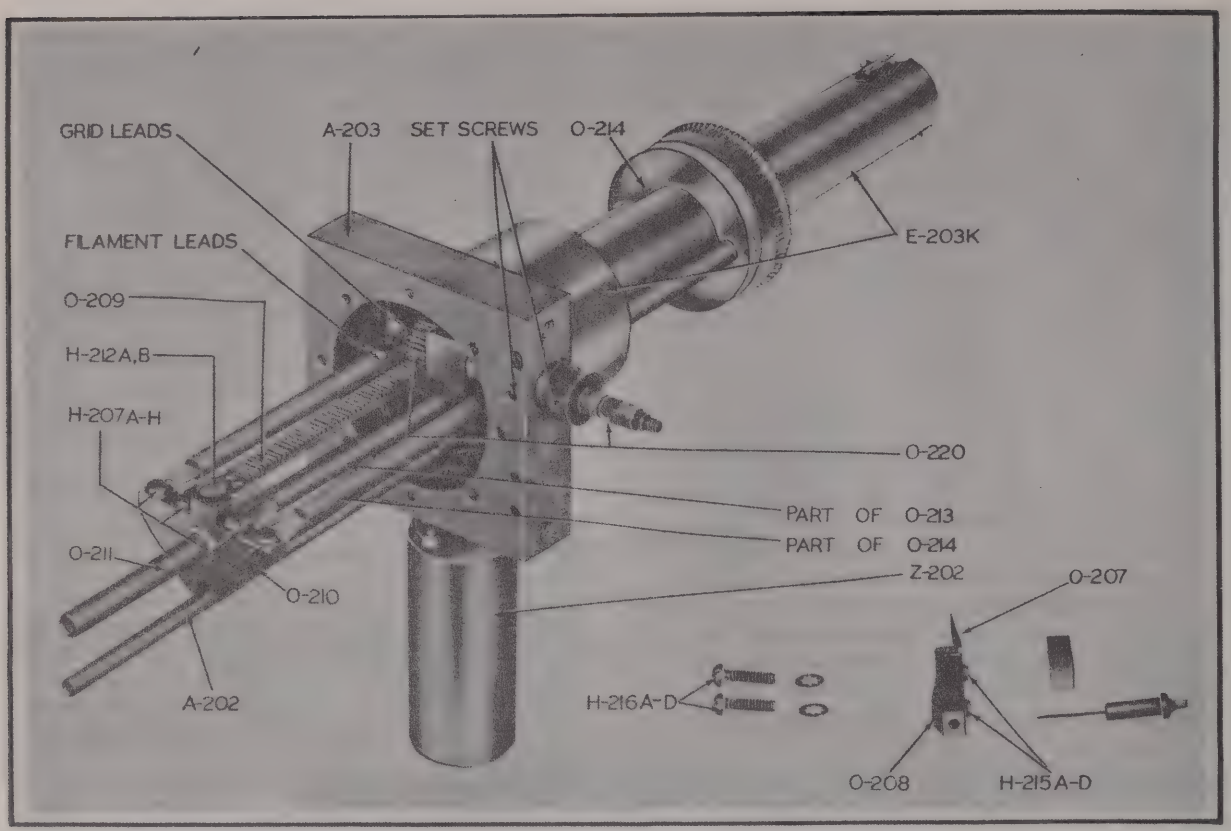


Figure 4-19. Grid Cylinder Section of Cavity

if disassembled, reassemble according to the detail drawing in the lower cutaway view of figure 7-10. Take the cathode cylinder and attached carriage guide plate O-212 out of the enclosing grid cylinder E-203K by pulling out the small push rods and attached grid cylinder brush O-213. Figure 4-22 shows these items out of the grid cylinder.

CAUTION

Take care not to pull suppressor L-212 (shown in figure 7-10) out of the grid cylinder retainer, thus breaking the grid lead W-202.

To avoid damage to the fingers on the plate brush O-214 while sliding it off the grid cylinder, first unsolder resistor R-203 from grid lead W-203 at the tie point within the phenolic grommet H-226, as shown in figure 4-23. It is not necessary to unsolder resistor R-203 from grid brush E-203J. Instead, remove the four mounting screws H-225A-D and associated phenolic washers, and take resistor R-203 along with grid brush E-203J out of the grid cylinder. Also take the loading slug (shown mounted in the grid cylinder in figure 7-10, Section VII, and exploded out of the grid cylinder in figure 4-23 of Section IV) by removing the two screws and lockwashers. Now slide the plate brush assembly gently off the grid cylinder.

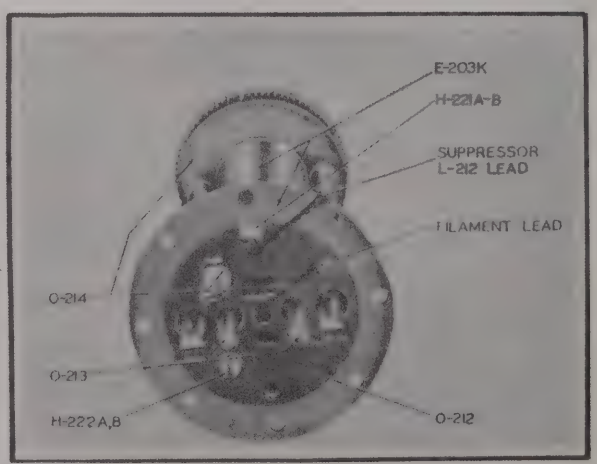


Figure 4-20. Grid Cylinder Section Partly Disassembled

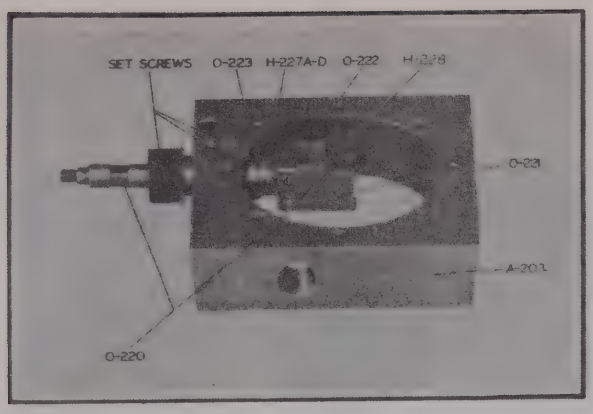


Figure 4-21. Cavity Support Block with Carriage Drive Shaft in Place

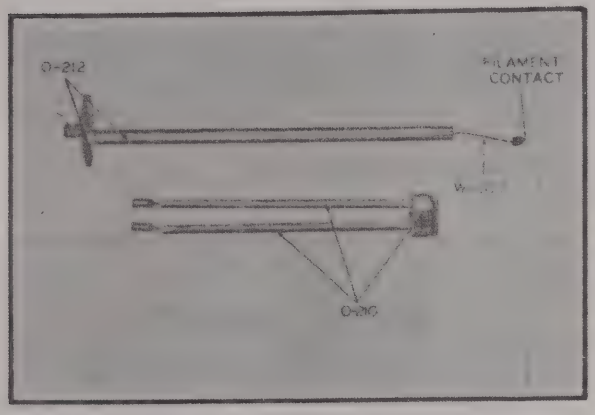


Figure 4-22. Cathode Cylinder and Grid Cylinder Brush

Should either the filament lead or filament contact become defective they must be replaced as a pair. Simply push old contact and lead out of the slotted end of the cathode cylinder. Insert the free end of the new filament lead W-203 into the cylinder from the slotted end, pushing the contact down in after it until it rests securely against a shoulder within the cylinder.

Replacement of the grid lead W-202 should never be required, but if for any reason replacement should become necessary, the following procedure should be observed. With the plate cylinder separated from the grid cylinder section and the plate cylinder brush O-214 removed, refer to figures 4-19 and 4-23, and the lower cutaway view of figure 7-10. By means of the suppressor lead, pull suppressor L-212 with its sleeving out from the counterbore in the grid cylinder retainer E-203K. Since the old grid lead W-202 will be damaged in these operations, a new one should be used. Solder one end of it to the short lead of suppressure L-212. Thread the other end of the new lead (W-202) through the hole behind the counterbore in the grid cylinder retainer E-203K, as shown in figure 7-10. Exercise care not to damage the insulation in this operation. Now seat suppressor L-212, encased in spaghetti sleeving, back into the counterbore in the grid cylinder retainer. After checking electrical continuity for possible short circuits, thread the free end of the grid lead through one of the pin holes in the wall of the phenolic grommet H-226 (see figure 4-23), bringing it up out of the "doughnut hole" of the grommet. Seat the grommet into the slot in the far end of the grid cylinder, pushing it back almost to the end of the slot. Pull the wire gently out from the "doughtnut hole" in the grommet to remove the slack. Then, beginning at suppressor L-212, use a blunt-edged tool to tamp the wire down into the longitudinal slot, taking the utmost care not to damage the insulation, and re-checking continuity and for "shorts" to the cylinder. The resistance between the free end of W-202 and the cylinder should be over several megohms.

Referring to figure 4-23, thread the free lead of R-203 through the second pin-hole in the wall of the phenolic grommet H-226 as shown, bringing it up slightly out of the "doughnut hole". Then twist the grid wire and R-203 lead together, drawing the grommet back till it rests securely against the end of the slot and with all grid wire slack removed, solder the leads together. Check that the other lead of R-203 is still securely soldered to the grid contact brush E-203J. Drop some clear glyptal into the longitudinal slot, running it along the wire. Capillary attraction will draw it into the slot. Allow the cement to dry for about 20 minutes, and then clean the grid cylinder to make certain no cement remains on the surface to interfere with clean contact between the fingers of the plate cylinder brush and the grid cylinder. The free lead of suppressor L-212 emerging from the hole in the carriage support guide O-212 shown in figure 4-20 is then resoldered to the inner lug on the adjacent standoff insulator. The green lead from the twin filter Z-202 is soldered to the same lug. It should be noted the outer lug on the standoff insulator is the tie point for the filament lead from the cathode cylinder and the brown lead from Z-202.

(3) TS-418A/U RF OSCILLATOR REASSEMBLY.—To reassemble the RF Oscillator, the procedure outlined above for its disassembly should be followed in reverse, checking the components against the varied views provided in this section as well as the exploded and cutaway views provided in figure 7-10 of Section VII.

(4) TS-418/U DISASSEMBLY AND REASSEMBLY.—Figure 4-24 shows the RF Oscillator subassembly E-203 mounted on the front panel of Signal Generator TS-418/U as seen from above, while figure 4-25 provides a top view of the subassembly after removal from the front panel. A rear view of the Oscillator subassembly is given in figure 4-26, and an oblique view is given in figure 4-27, showing V-201

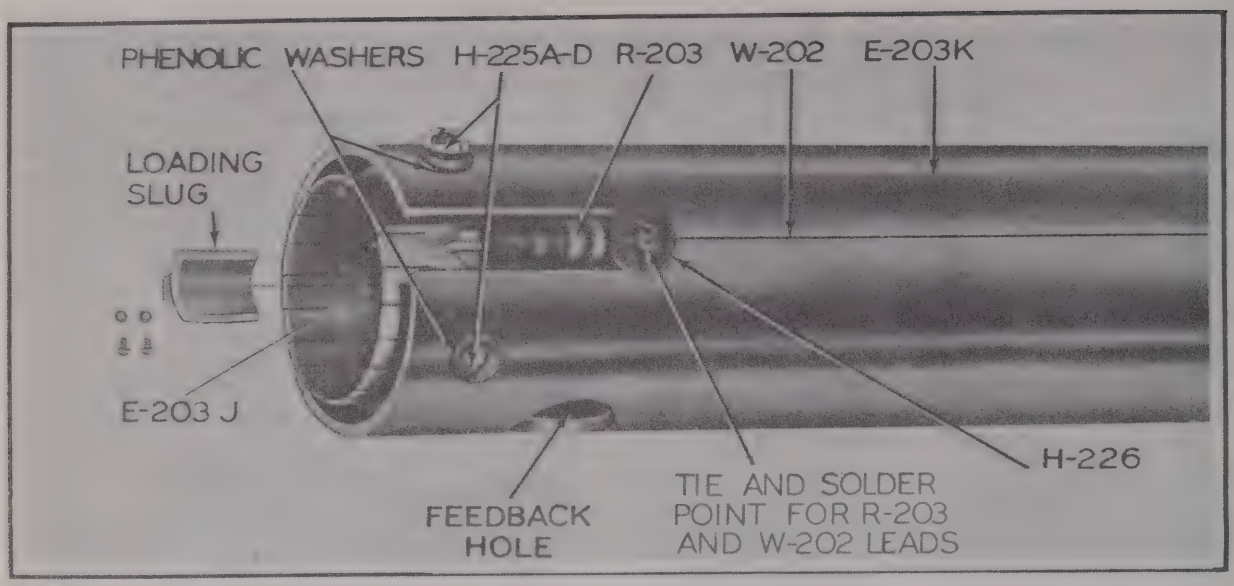


Figure 4-23. Disassembly of Oscillator Tube End of Grid Cylinder

in place. A sectional view is provided in figure 4-28 to show the frequency dials and associated gear train prior to disassembly. Figure 5-2 of Section V, which supplies a sub-chassis view, indicates leads that must be disconnected and a screw that must be withdrawn in the disassembly procedure. Some of the disassembly operations incidental to maintenance work are possible without removing the subassembly from the front panel of the instrument. Thus, it is possible to take out the UHF triode V-201 and the plate filter Z-201; to adjust or move the feedback screw H-208; re-set or remove the dial stop arms and associated items; and to remove the cavity end housing A-201 to check the carriage drive parts or test electrical continuity through the twin filter Z-202 at the standoff insulator. However, any disassembly beyond these simple operations requires the removal of the Oscillator subassembly from the front panel.

(*a*) REMOVAL OF OSCILLATOR SUBASSEMBLY FROM THE FRONT PANEL.—To remove the Oscillator subassembly from the front panel, invert the chassis and, while referring to figure 5-2 of Section V, remove jack J-201 by taking out the four front panel mounting screws. Unsolder the lead from the monitor unit E-203B at resistor R-351, mounted on the resistor board on the chassis wall. Also unsolder the white lead from the plate filter Z-201, and the brown and the green leads from the twin filter Z-202, shown in figure 4-26 of this section. Also take out the sub-panel mounting bracket screw shown encircled in figure 5-2 in Section V.

Now perform all the front panel disassembly operations described in paragraph *9a*(2)(*a*) of this section. Then lift the Oscillator subassembly from the front panel.

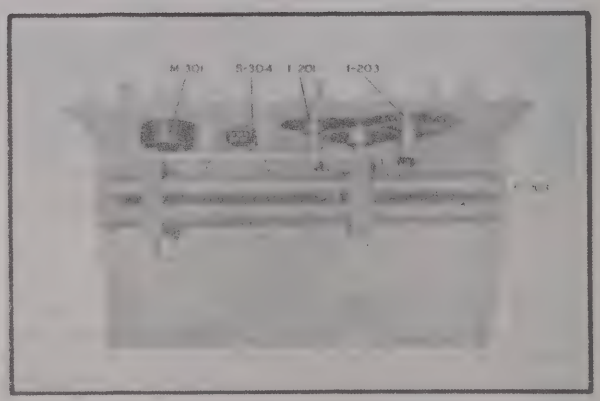


Figure 4-24. Signal Generator TS-418/U, Oscillator Sub-assembly Mounted on Front Panel

(*b*) REMOVAL OF CAVITY FROM SUB-PANEL.—Follow the disassembly procedure given for Signal Generator TS-418A/U in paragraph *9a*(2)(*b*) disregarding the steps relating to the cavity shield.

(*c*) DISASSEMBLY AND REASSEMBLY OF CAVITY.—Once removed from the sub-panel, the cavity proper in the TS-418/U is identical to the cavity in the TS-418A/U. To disassemble and reassemble the cavity, follow the procedure given in paragraphs *9a*(2)(*c*) and *9a*(3) respectively, of this section.

b. ELECTRICAL ADJUSTMENT.

(1) ADJUSTMENT OF FEEDBACK SCREW.—The position of the feedback screw H-208 in the

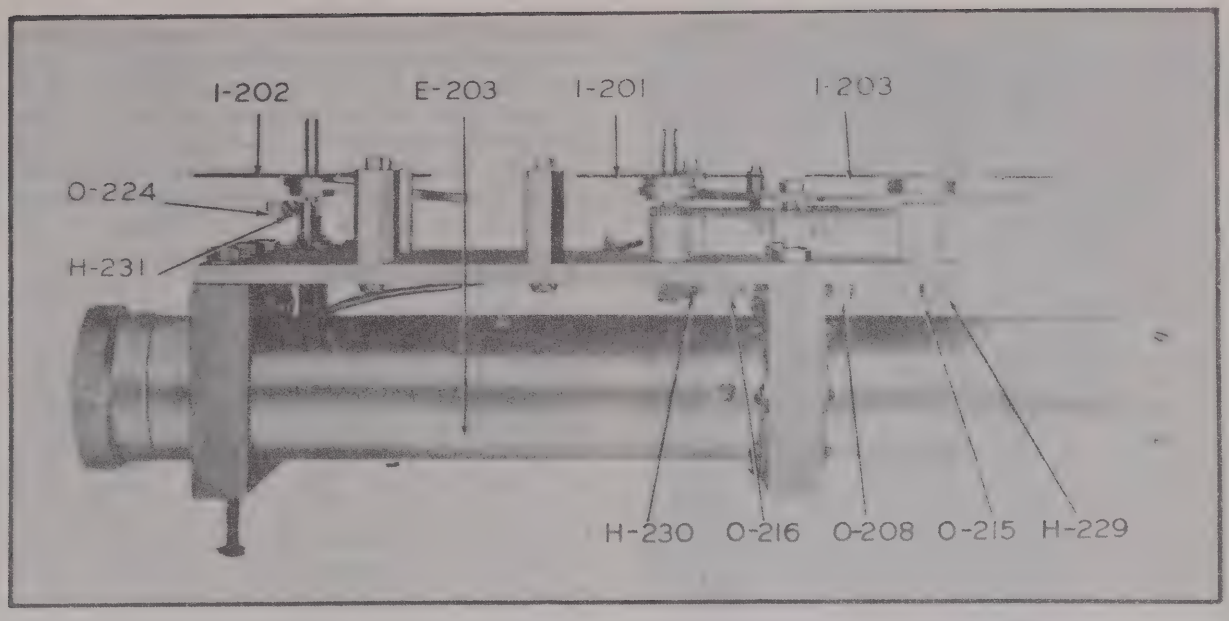


Figure 4-25. Signal Generator TS-418/U, Top View of RF Oscillator Sub-assembly Removed From Front Panel

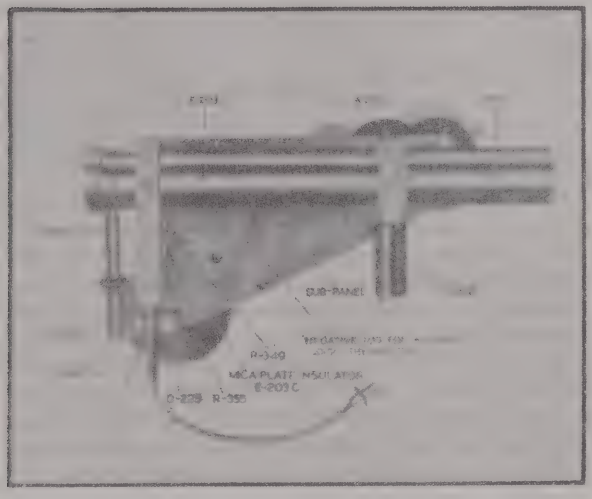


Figure 4-26. Signal Generator TS-418/U, Rear View of Oscillator Sub-assembly

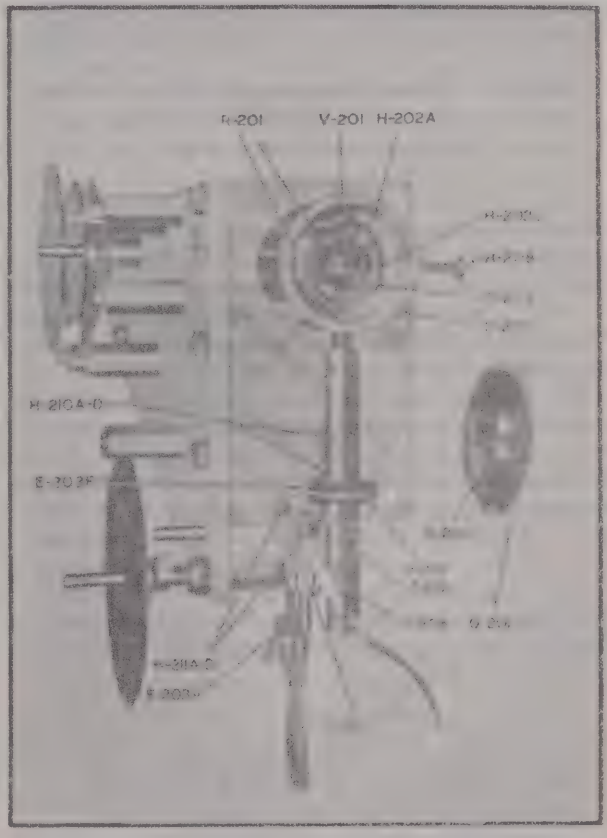


Figure 4-27. Signal Generator TS-418/U, Oblique View of Oscillator Sub-assembly Showing V-201 in Place

cavity determines the amount of feedback and, hence the magnitude of the plate and grid currents. If set in too far, the feedback screw will cause excessive plate and grid currents, unnecessarily shortening tube life. If set out too far, the lack of sufficient feedback will produce mode-hopping, that is, jumping from one frequency to another. The position of the feedback screw also affects the shape of the RF output pulse, producing overshoot on the leading edge of the pulse if not properly set, an effect that varies over the SIGNAL FREQUENCY MC dial. Moreover, the setting of the feedback screw also has a pronounced effect on the

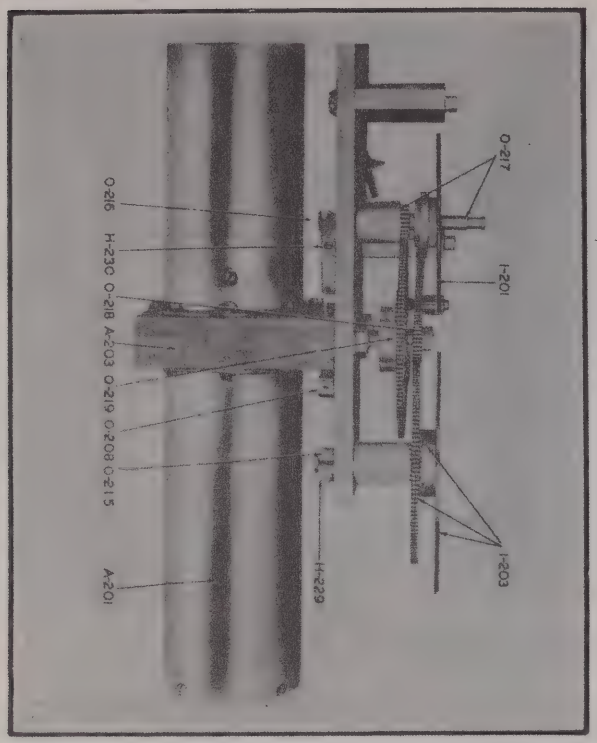


Figure 4-28. Signal Generator TS-418/U, Sectional View of Oscillator Sub-assembly with Frequency Dials and Gear Train in Place

calibration of the dial. Screwing the feedback screw in produces bandspread, while drawing it out causes band contraction. The setting of the feedback screw is thus a compromise, determined at the factory on the basis of best RF output pulse shape consistent with good dial calibration.

The setting of the feedback screw should, therefore, not be changed if not necessary, and then should be undertaken only if adequate test equipment is available for recalibrating the SIGNAL FREQUENCY MC dial according to the procedure given in paragraph *9b*(2) of this section. A very slight variation of the screw setting is possible, however, without causing the resulting dial calibration error to exceed the permissible one percent limit. This should be done only to reduce excessive overshoot on the leading edge of the RF output pulse.

Note

Changing tube V-201 (2C36) should not require adjustment of the feedback screw, as any dial calibration error should still not exceed the permissible one percent limit.

If, however, the setting of the feedback screw has been changed by more than two turns in either direction, or if the setting has been disturbed accidentally or for purposes of disassembly, it is necessary to recheck the accuracy of calibration of the SIGNAL FREQUENCY MC dial according to the procedure outlined in paragraph *9b*(2) of this section. If the feedback screw is reset, it is also necessary to check the accuracy of the PULSE WIDTH dial calibration in accordance with the procedure outlined in paragraph *7d* of this section.

To adjust the feedback screw, set the MODULATION SELECTOR switch on the TS-418A/U to PULSE and connect the RF OUTPUT jack to Oscilloscope TS-239/UP (or equivalent) through a crystal rectifier or other demodulating means and observe the pulse shape on the screen. Set the feedback screw initially so that only three threads are exposed above the attenuator block. Then vary the SIGNAL FREQUENCY MC control on the TS-418A/U to find the frequency with the most pronounced overshoot on the leading edge of the pulse. Adjust the feedback screw setting one or two turns in either direction to obtain minimum overshoot and best pulse shape. Restandardize output power of the TS-418A/U by adjusting the ZERO SET and PWR SET controls according to the procedure given in paragraphs *2b* and *3b* of Section II. Then re-examine the pulse shape. If necessary, repeat steps (*e*) and (*f*) to restore the best pulse shape. Check the dial calibration at 400, at 700, and then at 1000 megacycles. If the calibration error exceeds the permissible one percent limit, recalibrate the dial according to the procedure in paragraph *9b*(2) of this section.

In case of doubt as to the best setting of the feedback screw, as a satisfactory compromise adjust the feedback screw to give a grid current of eight milliamperes. Connect a 0-10 milliammeter in the grid lead of V-201 at the terminal of resistor R-332 shown in figure 5-5 of Section V. For this adjustment, set the SIGNAL FREQUENCY MC dial to 400, turn the PWR SET control to its maximum clockwise position, and then adjust the setting of the feedback screw to give a meter indication of eight milliamperes.

(2) CALIBRATION OF SIGNAL FREQUENCY MC DIAL.—In order to check the frequency calibration of Signal Generator TS-418/U, it is necessary to have a frequency-measuring device which will cover the range from 400 to 1000 megacycles. This device will preferably be Wave Meter TS-127/U and 135-S or a beat-frequency system such as Frequency Meter TS-186/AP that will allow the output of the signal generator to be beat against harmonics of a known oscillator. In general, satisfactory results can be obtained more simply with the wave meter and TS-418/U has been calibrated by means of such a system. The calibration of TS-418/U is designed to be accurate within 1% and, in fact, is usually within ¼ of 1%. This is the order of accuracy with which it is possible to read the main tuning dial.

If the Oscillator has been taken apart at all and reassembled, it is desirable to turn the main tuning shaft slowly throughout its range and determine that the reading of the power level meter does not drop to zero at any frequency. As the output frequency is decreased, the meter reading should decrease smoothly. Erratic operation usually is caused by the cavity wiper making poor contact.

Referring to figures 4-5, 4-6, 4-8, and 4-28, loosen retaining nut for dial drive gear O-218 (figure 4-28) so that gear O-218 and anti-backlash gear meshed with it and associated frequency dial I-203 turn freely. Avoid excessive pressure on this nut so as not to cause the hardened shaft (O-220, figure 4-14) to fracture. Loosen the dial stop cams O-215 and O-216 located behind the sub-panel, as shown in figure 4-8 for the TS-418A/U and in figure 4-28 for the TS-418/U. Withdraw the tuning screw H-232 (figure 4-8) one-half inch. With the wavemeter (or the harmonic signal generator) set to 1000 megacycles, turn the frequency control on the TS-418A/U (or TS-418/U) until the wavemeter deflection reaches a maximum (or until zero beat is reached on the harmonic signal generator). Then restandardize power on the TS-418A/U (or the TS-418/U) by adjusting the ZERO SET and PWR SET controls as described in paragraphs 2*b* and 3*b* of Section II. If necessary, readjust the position of the frequency control until the POWER SET meter M-301 reads 0 dbm for the 1000 megacycle setting of the wavemeter (or harmonic signal generator). Without disturbing the setting of the vernier dial I-201 (figures 4-5 and 4-8), secure dial in this position by means of its LOCK on the front panel. Now rotate frequency dial I-203 to 1000. Holding dial drive gear O-218 and the anti-backlash gear attached to dial I-203 in this position by using a spare gear or other convenient tool to mesh with them, tighten the gear retaining nut on shaft O-220 (figure 4-14). Then loosen the vernier dial LOCK on the front panel and rotate the frequency control until dial I-203 reads 700. Again restandardize power output on the TS-418A/U (or TS-418/U). With the wavemeter (or harmonic signal generator) set to 700 megacycles, screw in the tuning screw H-232 (figure 4-8) until the frequency of the RF output signal approaches as close as possible to 700 megacycles as indicated on the wavemeter (or the harmonic signal generator). This adjustment can be made more easily by switching the MODULATION SELECTOR switch on the TS-418A/U (or the TS-418/U) to PULSE and listening to the wavemeter output on earphones.

Then check the calibration at spaced intervals over the dial, noting points of maximum and minimum percentage of error. If the error is within the permissible one percent limit but greater accuracy is desired, reset the dial, dividing the difference in error between the maximum and minimum points equally and balancing a positive error at one end of the dial against a negative error at the other. In some cases the dial calibration error may be minimized by loosening the two front panel screws which mount the escutcheon carrying the index hairline between the two frequency dials, and then shifting the escutcheon up or down as required. If resetting the dial fails to bring the calibration within the one percent error limit, it is necessary to readjust the setting of the feedback screw H-208 and again calibrate the SIGNAL FREQUENCY MC dial according to the procedure given in this paragraph. If the dial error then still exceeds the one percent limit, and no error has been made in carrying out the required adjustment, a new 2C36 tube should be tried and the calibration procedure repeated. As a last resort in an extreme case, calibrate a new dial for the particular instrument.

To set dial stop cams O-215 and O-216, figure 4-8, rotate dial I-203 to .010. Dial stop cam O-215 should now push down on the dial stop arm O-208 (see figures 4-8, 4-14 and 4-25), forcing it through the cavity support block A-203 where the pin projects above cam O-216, blocking further movement upward of this cam and of the dials in the clockwise direction. Tighten set-screw H-229 to lock cam O-216 in this position. Then change the signal frequency to below 400 megacycles. Cam O-215 should now push up against the dial stop arm O-208, with cam O-216 pushing down on the dial stop pin. It may be necessary to check several trial positions before the best setting of the cams is achieved.

After the frequency calibration has been checked, Signal Generator TS-418A/U (or TS-418/U) should be adjusted for pulse modulation by setting the modulation selector switch to the PULSE position and the SYNC SELECTOR switch to either the X1 or X10 position. The RF output pulse should be viewed on an Oscilloscope TS-239 or equivalent.

Trigger the oscilloscope from the SYNC OUT connector. The RF OUTPUT jack of TS-418A/U (or TS-418/U) is connected through a crystal demodulator to the vertical input terminals of the TS-239. Set the PULSE DELAY control for about 5 microseconds delay and the PULSE WIDTH control to approximately 5 microseconds. Set the oscilloscope sweep to about five microseconds per inch and examine the pulse shape.

Tune TS-418A/U (or TS-418/U) over its entire frequency range to ascertain that it is operating properly at all frequencies. The output power should be checked frequently (see paragraph 2*b*(2) of Section II) in order to apply the proper plate voltage to the RF Oscillator. If the pulse shows a tendency to start at one amplitude and then jump to a different amplitude at the low end of the frequency range, the Oscillator is mode-hopping, that is, jumping from one frequency to another. Mode-hopping is generally caused by insufficient feedback or by the grid brush being placed too far forward (toward the oscillator

tube V-201) with respect to the plate brush. Note that the push rod tie-downs are equipped with elliptical screw holes to permit independent adjustment of the electrical line lengths.

If mode-hopping occurs, turn the feedback screw in slightly. The feedback screw should not be screwed in farther than necessary since the oscillator tube will draw excessive plate and grid currents and its life will be unnecessarily shortened if too much feedback is employed. It is important to read paragraph *9b*(1) before adjusting the feedback screw.

(3) CALIBRATION OF ATTENUATOR DIAL.—The operation of the PWR SET control should be checked to make certain that the power level meter pointer can be set to the mid-scale mark or a reference dbm mark on either side of it at all frequencies. For making this adjustment the cw power output of Signal Generator TS-418A/U (or TS-418/U) should be measured with a bolometer bridge. This may be of the 50 ohm broad band or of the tuned type. (If tunable it should be tuned for maximum). The adjustment consists in setting the position of the attenuator to read 1 milliwatt on the external bolometer meter and setting the attenuator dial to read 0 dbm (that is, 1 milliwatt). The bolometer circuit will include a thermistor mount to match the 50 ohm RF line to the 200 ohm thermistor bridge. With a 50 ohm coaxial cable connection from the RF OUTPUT jack of the signal generator and a DC line connection between the thermistor and a wattmeter bridge, the following procedure should be followed.

(*a*) Loosen the attenuator dial.

(*b*) Turn RF to OFF and zero the PWR SET meter.

(*c*) Turn RF to ON and adjust the PWR SET control so the meter pointer is on the red mid-scale line.

(*d*) Adjust the thermistor mount for greatest response on wattmeter bridge.

(*e*) Disconnect RF line; zero wattmeter bridge; then reconnect RF line.

(*f*) Quickly re-zero the Power Set meter with RF OFF, then with RF ON again bring the meter pointer to mid-scale, measuring the power on the wattmeter quickly since both the meters drift.

(*g*) Again disconnect the RF input line, and again zero the wattmeter bridge.

(*h*) Now reconnect the RF line to the thermistor mount. Move attenuator probe in or out until wattmeter reads 1 milliwatt with the POWER SET still at the mid-scale position.

(*i*) Re-check all readings to be certain of the calibration.

(*j*) Then set the dial to 0 dbm and tighten the set screws on the attenuator dial hub.

(*k*) Re-check the power as above to be sure it has not changed.

(*l*) Tune to 1000 mc and be certain it is possible to obtain 1 milliwatt at the corresponding Power Set.

(4) DETERMINATION OF PERCENTAGE OF AMPLITUDE MODULATION.—The required amplitude of the sinusoidal signals at the EXT MOD terminal for 30% amplitude modulation varies with the RF carrier frequency. This is due to the fact that conventional plate modulation of the RF Oscillator is employed and the dc plate voltage for calibrated output power varies with carrier frequency. Several methods for determining the signal amplitude required to produce 30% modulation are outlined below.

(*a*) When amplitude modulation is applied, the total RF power (P_t) increases in accordance with relation:

$$P_t = P_o \left(1 + \frac{M^2}{2}\right)$$

Where P_o = power in the modulated wave
M = Modulation factor
= 0.01
(percent modulation)

For 30% modulation $P_t = 1.045\ P_o$, which represents an increase in power of 0.191 db. Since the power monitor responds to total power, if the amplitude of the modulating signal is increased, until the POWER SET meter increases to 0.191 db the RF wave will be modulated to a depth of 30%.

(*b*) Connect the output RF signal to Oscilloscope TS-239/UP or Oscilloscope TS-34/AP via a UHF crystal detector and a high gain video amplifier. Note the OUTPUT ATTENUATOR reading, increase the output power by 5.38 db and note the number of divisions increase in pulse height. Now reduce the output power 2.28 db by means of the attenuator. Switch the MODULATION SELECTOR to AM and increase the modulating signal until the peak to peak signal amplitude on the oscilloscope equals the number of division changes in pulse height noted above. The output RF signal is now modulated 30%.

EXAMPLE: Carrier Frequency 500 mc.

OUTPUT ATTENUATOR 30.38 dbm — Pulse height 3.8 divisions.

OUTPUT ATTENUATOR 25.0 dbm—Pulse height 12.0 divisions.

Divisions increase in pulse height = 8.2. Set OUTPUT ATTENUATOR at 28.1 dbm. An input to the EXT MOD connector of 1.7 V rms produces a peak to peak oscilloscope deflection of 8.2 divisions indicating a modulation depth of 30%.

(*c*) Since conventional plate modulation of the RF Oscillator is employed, the percentage modulation can be calculated by measuring the AC and DC components of the RF Oscillator plate voltage on the

lead to the plate filter. For example, for 30% amplitude modulation the rms component of the Oscillator plate voltage should be (0.3) X (0.707) X (DC plate voltage) = (0.212) X (DC plate voltage). Measure the DC plate voltage, calculate the required modulating voltage and increase the input voltage at the EXT MOD connector until the required AC voltage is obtained on the plate lead.

10. REPLACEMENT OF RESISTOR R-201.—To replace the plate filter resistor R-201, proceed as for replacing V-201. See paragraph *6a*, Section IV.

11. REPLACEMENT OF RESISTOR R-203.—Replacement of R-203 is described as part of the procedure for replacing the oscillator grid lead in paragraph *9a*, of Section IV.

12. REPLACEMENT OF RESISTORS R-349 and R-355.—As the two disc thermistors R-349 and R-355 in the TS-418A/U are not replaceable without removal of the cavity from the shield, make every effort to determine that they are actually causing trouble before attempting to replace them. The procedure necessary to render the thermistors accessible is given in paragraph *9a*(2) of this section.

In the TS-418/U the disc thermistors are accessible from the rear of the instrument without any disassembly.

13. REPLACEMENT OF RESISTOR R-202.—The mounting position of resistor R-202 (line matching resistor) is shown in the cutaway view of the attenuator unit, figure 5-6 of Section V. This resistor should never give trouble since it is ruggedly mounted in a well-protected position. Owing to the very low power absorbed by it, it can scarcely burn out. The unit design is such that replacement of R-202 in the field is impracticable. If any part of the attenuator unit becomes defective a new one should be installed.

14. REPLACEMENT OF R-204.—The bead thermistor R-204 may be replaced without removing the RF Oscillator subassembly from the front panel. In the case of the TS-418/U, after noting carefully the setting of the monitor in its waveguide to facilitate returning it to this position, loosen the set-screw with an Allen wrench and pull the monitor from the attenuator block. In the case of the TS-418A/U, it is first necessary to remove the attenuator shield cover O-226, shown in figure 4-4, sliding it out of the way along the attenuator cable. Referring to figure 4-11, note the position of the monitor in its waveguide. Then, with a screwdriver unscrew the set-screw shaft a few turns through the port in the side bracket (see figure 4-1). By means of the monitor positioning shaft shown in figure 4-13, withdraw the monitor from the attenuator block.

CAUTION

Do not pull on the wire lead connected to the monitor unit.

Noting the location of the bead thermistor in figure 5-6 of Section V and figure 7-10, Section VII, unsolder the old thermistor from the pick-up loop and the outer mica button capacitor and solder in a new thermistor, using a minimum of heat and solder.

CAUTION

Excessive heat will damage the bead thermistor.

Note

Do not disturb the position of the loop itself in this operation. Replacement of the loop is impractical. If the loop is defective a new monitor unit should be installed. However, before replacing the monitor in the TS-418/U, read paragraph *9b*(15) of this section.

After restoring the monitor to its approximately correct position, make the final adjustment according to the following procedure.

Note

The monitor unit must be correctly oriented when seated in the waveguide so that the set-screw which locks it in place is screwed against the flat side provided near the lower end of the unit. When correctly placed, the plane of its loop is parallel with that of the attenuator loop and with the axis of the cavity as shown in figure 7-10 of Section VII.

Adjust the position of the monitor unit so that it will always be possible to maintain the POWER SET meter at or close to the half scale 0 dbm line at the center of the dial over the entire frequency range when standardizing power according to the procedure given in paragraph *2b* and *3b* of Section II.

If the original position of the monitor unit is not known, as a first step set the monitor so that only one-fourth inch remains outside the attenuator block and lock in this position with its set-screw. Turn both the POWER switch and the RF switch to ON. After a 20 minute warm-up period, turn the RF switch to OFF. Move the meter needle to the ZERO SET line at the extreme left on the meter scale by means of the ZERO SET control. Turn the MODULATION SELECTOR switch to CW, the RF switch to ON, and, with the PWR SET control, set the meter needle to the 0 dbm mark in the center of the scale. Tune the TS-418A/U (or TS-418/U) through the entire frequency range to find the point of maximum power output. Turn the PWR SET control until it is possible to set the meter needle at or below the 0 dbm line. If the meter reads higher than +½ dbm at the point of maximum power output, withdraw the monitor unit slightly until the meter indicates approximately +½ dbm. Change the frequency of the signal

to 400 megacycles. If it is then not possible for the meter needle to reach the 0 dbm line, set it as close as possible to the 0 dbm line, and add the indicated number of decibels to the dbm scale on the OUTPUT ATTENUATOR dial.

After the monitor unit has been set as outlined above, check the calibration of the OUTPUT ATTENUATOR dial according to the procedure given in paragraph 9*b*(3) of this section.

15. REPLACEMENT OF ATTENUATOR OR MONITOR UNITS.—The TS-418A/U monitor and attenuator units may be changed independently of each other. If either of these units is replaced in the TS-418/U, however, it will be replaced by a unit designed for the TS-418A/U. However, if either unit is so replaced, it is necessary to replace both, owing to a slight difference in construction and in the electrical characteristics between the TS-418A/U and the TS-418/U units. Cutaway views of these units are provided in figure 5-6 of Section V.

16. REPLACEMENT OF SHIELD FILTERS.—Since filters Z-203, Z-204, Z-206, Z-302, Z-303, and Z-304 are identical electrically and physically (except for the colored wire leads) only Z-203 is supplied as a spare. If any of these filters needs replacement, install Z-203 after removing the white lead and soldering in the correctly colored lead as indicated on the wiring diagram, figure 7-6 of Section VII.

17. REPLACEMENT OF JACKS J-302, J-303, J-304, or J-305.—RF leakage filters are mounted as integral parts of the input and output jacks in the Modulator section. Replacement of any of these jacks or filters involves replacement of both elements as single units. Repair of the filter should not be attempted. If any filter becomes defective a new unit should be installed.

TABLE 4-2. WINDING DATA

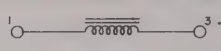
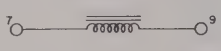
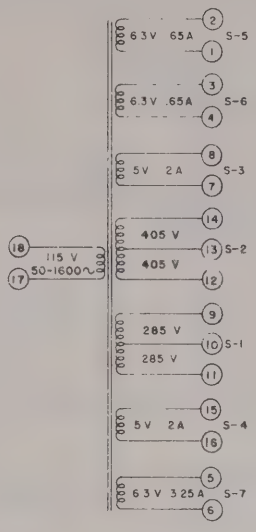
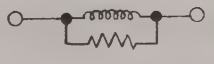
REF. SYMBOL	NAVY TYPE DESIGNATION	DIAGRAM	WINDING	WIRE SIZE	D C RESIST. IN OHMS	TURNS	REMARKS
L-101A				33	265	3210	10 h. @ 75 ma. 1500 V test
L-101B				30	160	3100	10 h. @ 125 ma. 1800 V test
L-201				20E	Less than 1 ohm	7	
L-202				20E	Less than 1 ohm	9	0.185 *uh*
L-203				20E	Less than 1 ohm	12	0.265 *uh*
L-204				20E	Less than 1 ohm	10½	0.3 *uh*
L-205				20E	Less than 1 ohm	10½	0.3 *uh*
L-206				20E	Less than 1 ohm	8	0.158 *uh*
L-207				20E	Less than 1 ohm	9	0.185 *uh*
L-208				20E	Less than 1 ohm	9	0.158 *uh*
L-209				20E	Less than 1 ohm	8	0.185 *uh*
L-210				20E	Less than 1 ohm	9	0.185 *uh*
L-211				20E	Less than 1 ohm	9	0.185 *uh*
L-212				30E	Less than 1 ohm	12	0.23 *uh* wound on 470K ohm ½ WT resistor R-212
L-213				20E		12	0.265 *uh*
L-214				20E		12	0.265 *uh*

TABLE 4-2. WINDING DATA (Continued)

REF. SYMBOL	NAVY TYPE DESIGNATION	DIAGRAM	WINDING	WIRE SIZE	D C RESIST. IN OHMS	TURNS	REMARKS
T-101			PRI 1	No. 19		257	1500 V Test
			SEC. 1	No. 33		1340	1500 V Test
			SEC. 2	No. 33		1900	1800 V Test
			SEC. 3	No. 22		12	1500 V Test
			SEC. 4	No. 22		12	1800 V Test
			SEC. 5	No. 24		15	1500 V Test
			SEC. 6	No. 24		15	1500 V Test
			SEC. 7	No. 16		15	1500 V Test
T-301			PRI	No. 36	5.5	50¼	In hermetically sealed can
			SEC.	No. 36	5.5	50¼	12.5 h ± 10% at 1,000 c.p.s. each section
T-302			SEC.	No. 36	5.5	50¼	12.5 h ± 10% at 1,000 c.p.s. each section
T-303			SEC.	No. 36	5.5	50¼	12.5 h ± 10% at 1,000 c.p.s. each section
Z-301				38SNE		250	295 *ub* Shunted by 3300 ohm damping resistor; permanently sealed unit.

SECTION V
SUPPLEMENTARY DATA

1. TUBE AND LAMP COMPLEMENT.

The quantities and functions of the tubes and lamps used in Signal Generator TS-418/U are shown in table 5-1.

TABLE 5-1. TUBE COMPLEMENT

QUANTITY	TYPE	SYM. DESIG.	FUNCTION
1	5Y3GT	V-101	Rectifier for -200 volt supply
1	5R4GY	V-102	Rectifier for -400 volt supply
5	6J6	V-103	Amplitude modulator
		V-303	Pulse Delay multivibrator
		V-304	Snyc Out blocking oscillator
		V-305	Pulse-Width multivibrator-pulse inverter
		V-307	Delayed Sync Out blocking oscillator
2	6AG7	V-104	Voltage regulator series tube
		V-306	Width multivibrator: pulse modulator
1	6AK5	V-105	Voltage regulator control tube
2	0B2	V-106	Regulator for Thermistor bridge voltage and cathode voltage of V-105
		V-107	Regulator for -107V, -30V and -10V
1	2C36	V-201	RF Oscillator
1	12AX7	V-301	External Sync amplifier
1	12AT7	V-302	Pulse Rate blocking oscillator and series limiter
	Mazda #47	E-108	Power indicator lamp
		E-107	Heater, indicator lamp

2. GENERAL CHARACTERISTICS.

A summary of the physical and operating characteristics and limits of Signal Generator TS-418/U is given in table 5-2.

TABLE 5-2. GENERAL CHARACTERISTICS.

FREQUENCY RANGE	400 to 1000 megacycles in one band
ACCURACY OF FREQUENCY DIAL	±1%
MAXIMUM POWER OUTPUT (RF Signal)	1 milliwatt into a 50 ohm load
ATTENUATOR	The calibrations refer to CW or peak pulse power or voltage into a 50 ohm
d b m scale	load 0 to -120 decibels below 1 milliwatt
Microvolt scale	200,000 to 0.2 microvolts
Accuracy of Attenuator Dial	±2db
OUTPUT IMPEDANCE	50 ±2% ohms, resistive
STANDING WAVE RATIO OF OUTPUT SYSTEM	Less than 3 db.
PULSE MODULATION	
Internal Pulse Modulation:	
Pulse Repetition Rate	Adjustable from 40 to 4,000 pulses per second in two ranges
Accuracy	25%
Pulse Width	Adjustable from 0.5 to 10 microseconds
Pulse Rise Time	Not more than 0.5 microsecond between points that are 10% and 90% of maximum amplitude of initial rise
Pulse Decay Time	Not more than 0.5 microsecond between points that are 10% and 90% of maximum amplitude on the final decay
Pulse Delay	Start of RF pulse delayable over a range from 3 to 300 microseconds or 75% of period between pulses, whichever is smaller. Delay is relative to output synchronizing pulses.
Synchronization	Internal pulse modulation can be synchronized with external pulses or external sine waves
External Synchronizing Pulses:	
Required Peak Amplitude	Between 10 and 50 volts
Polarity	Positive or negative
Required Duration	From 0.5 to 20 microseconds between points that are 50% of maximum amplitude of initial rise
Required Flatness	Between 90% point of initial rise and 90% point on final decay amplitude must remain between 90% and 100% of maximum amplitude of initial rise
Impedance at SYNC IN Terminal	
Positive Pulses	10,000 ohms shunted by 115 mmf
Negative Pulses	8,200 ohms shunted by 110 mmf
DC Level	Between +10 V and -10 volts
Repetition Rate	Between 40 and 4,000 c.p.s.
External Sine Waves Synchronization:	
Required Amplitude	Between 10 and 50 volts RMS
Impedance at Sync Input Terminal	10,000 ohms shunted by 115 mmf
Frequency	Between 40 and 4,000 c.p.s.
External Pulse Modulation:	
Positive Pulses	
Amplitude	40 volts minimum

TABLE 5-2. GENERAL CHARACTERISTICS (Continued)

Input Impedance	10,000 ohms shunted by 115 mmf	
Negative Pulses		
Amplitude	40 volts minimum	
Impedance at EXT MOD Terminal	Minimum 8300 ohms shunted by 300 mmf	
Delay from External Pulse to RF Pulse	1 to 1.5 microseconds	
External Amplitude Modulation:		
Modulation Frequency Range	100 cycles to 100 KC	
Required Amplitude	3 volts maximum for 30% modulation. Varies with carrier frequency	
Impedance at EXT MOD Terminal	10,000 ohms shunted by 315 mmf	
Synchronizing Output Pulse Characteristics (typical)		
	With external load of 500 ohms shunted by 1500 mmf	No Load
Duration	0.3 to 5 u. sec.	0.3 to 5 u. sec.
Rise Time	0.18 u. sec.	0.18 u. sec.
Decay Time	0.45 u. sec.	0.45 u. sec.
Amplitude	42 v. peak	65 v. peak
Delayed Synchronizing Output Pulse Characteristics (typical)		
	With external load of 500 ohms shunted by 1500 mmf	No Load
Duration	0.3 to 5 u. sec.	0.3 to 5 u. sec.
Rise Time	0.2 u. sec.	0.2 u. sec.
Decay Time	0.45 u. sec.	0.45 u. sec.
Amplitude	45 v. peak	65 v. peak
POWER SOURCE REQUIRED		
Voltage, AC	115V.±10%	
Frequency	50 to 1600 cycles	
Power	130 watts at 115 volts, 60 cycles	
AMBIENT TEMPERATURE RANGE	-40°C (-40°F) to +55°C (+131°F)	
MAXIMUM RELATIVE HUMIDITY	In excess of 95 percent	

3. SIGNAL GENERATOR CONSIDERATIONS.

When using Signal Generator TS-418/U, it must be remembered that the external load on the instrument should be 50 ohms resistive for best accuracy in measurements. The output attenuator dial has been calibrated by using a load which is the conjugate of the internal impedance of the signal generator, that is, a load which draws maximum power from the instrument through the rf cable provided. At the same time the internal impedance of the generator has been maintained sufficiently close to 50 ohms so that in the worst case only a three db VSWR exists when the generator is used as a passive load for a 50 ohm line. An indication of the value of load impedance is contained in the VSWR on the line connecting the generator and the load. The VSWR can be measured by inserting a suitable slotted line between the line and load, and is the only practical method of obtaining an indication of the nature of the load. As an aid in using the generator the table below gives the maximum and minimum power loss in db as a function of VSWR measured on the line between the generator and load. The losses listed are referred to the maximum power which the generator can supply, as described above. The actual loss for any load impedance, line length and frequency is between the maximum and minimum values (from the table) for a given measured VSWR. The table indicates why, if minimum loss is to be assured, the load should be made such that the measured VSWR is held to a minimum, i.e., load impedance equal to fifty ohms resistive. The data does not allow for losses in the transmission line to the load but in most cases such losses are negligible.

VSWR in Line	Max. Power Loss	Min. Power Loss
1.0	1.2 db	1.2 db
1.5	2.2 db	0.5 db
2.0	3.1 db	0.2 db
2.5	3.9 db	0.1 db
3.0	4.4 db	0 db
4.0	5.4 db	0.1 db
5.0	6.1	0.3 db

Although the losses as shown in db do not consist of large numerical values, it should be noted that they may represent a considerable change in the voltage calibration of the output attenuator dial insofar as the voltage impressed across the external load is concerned.

In most cases when making measurements on receivers designed to work from a 50 ohm line and antenna, the standing wave ratio in the line from the signal generator to the receiver is not significant. The reason for this is that any power reflected from the receiver back towards the generator represents a deficiency in receiver design and the amount of power lost in such cases is considered as a loss subtractive from the gain of the receiver.

A sometimes-overlooked factor which contributes error in high-frequency measurements is the improper assembly of coaxial connectors. A standing wave ratio of several db with attendant error can often be attributed to this cause.

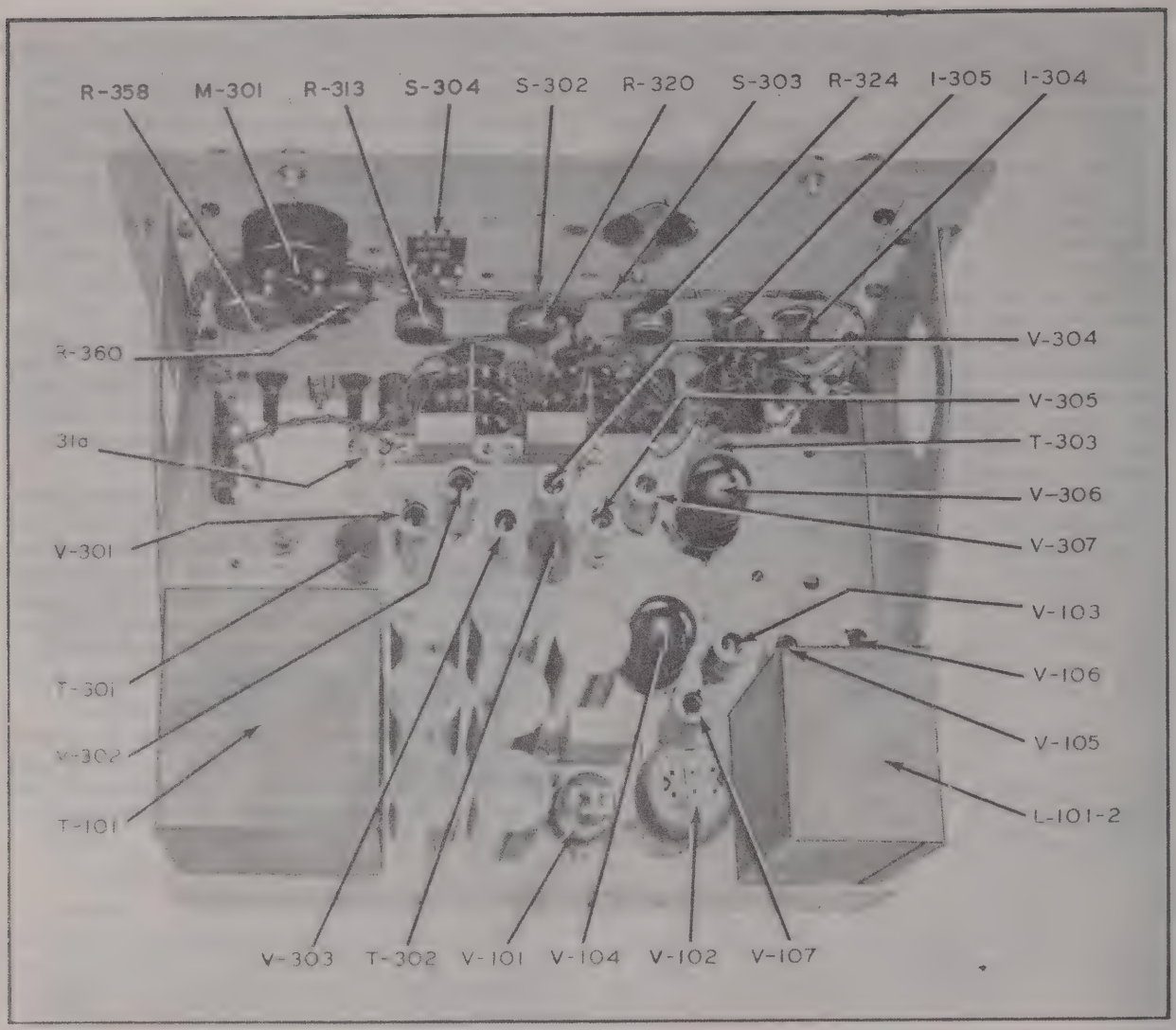


Figure 5-1. Signal Generator TS-418/U, Top View with Instrument Case and Oscillator Assembly Removed

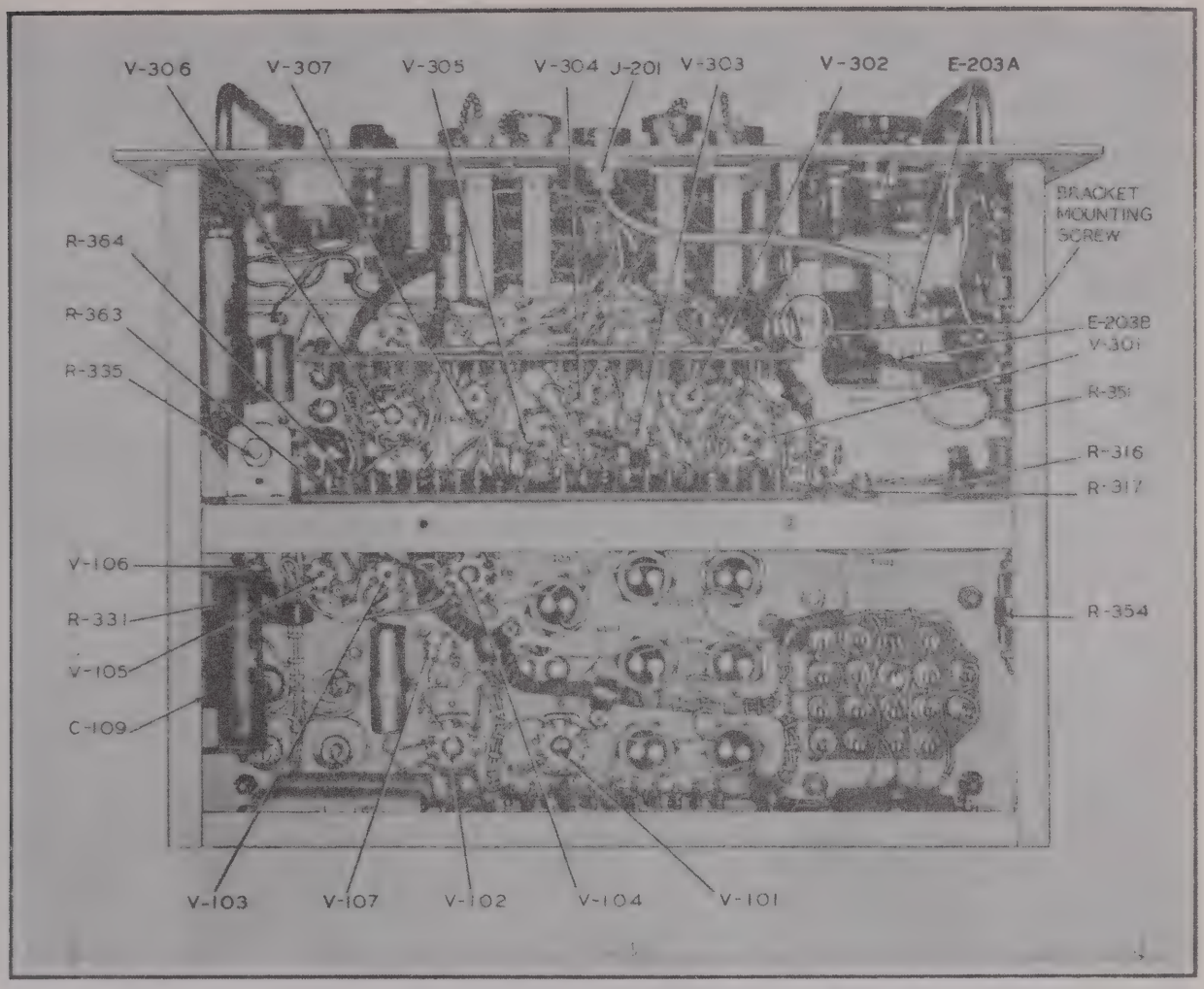


Figure 5-2. Signal Generator TS-418/U, Bottom View with Instrument Case Removed, Showing Location of Vacuum Tubes

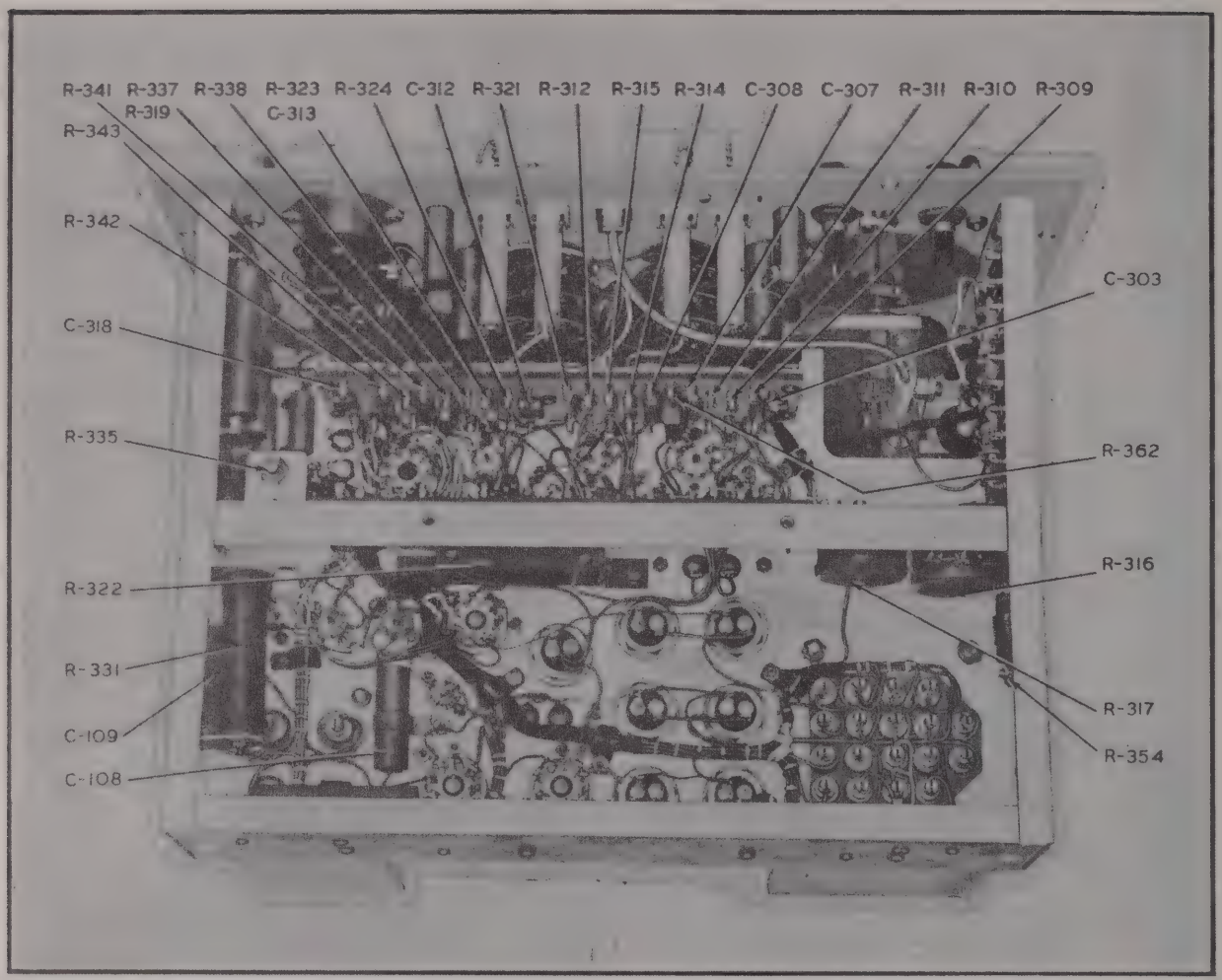


Figure 5-3. Signal Generator TS-418/U, Bottom View with Instrument Case Removed, Looking Toward Front Panel

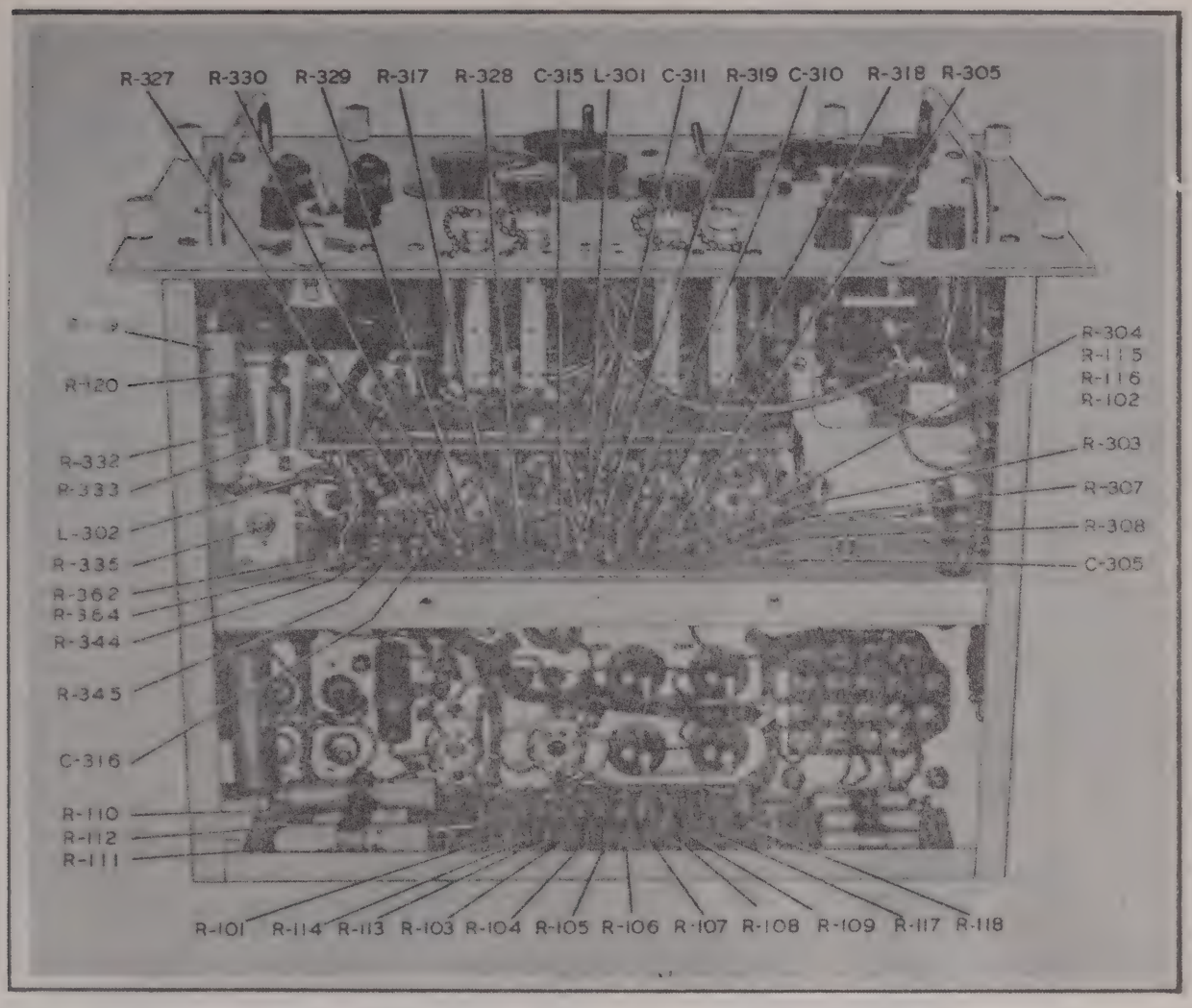


Figure 5-4. Signal Generator TS-418/U, Bottom View with Instrument Case Removed, Looking Toward Rear

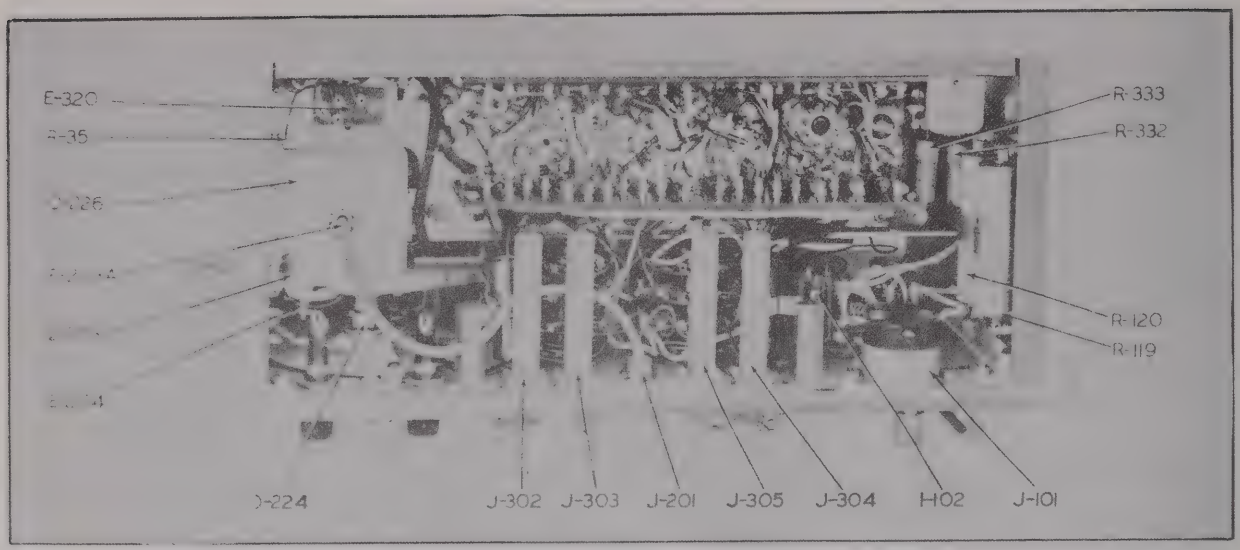


Figure 5-5. Signal Generator TS-418A/U, Sectional Sub-Chassis View Showing Shielded Cavity

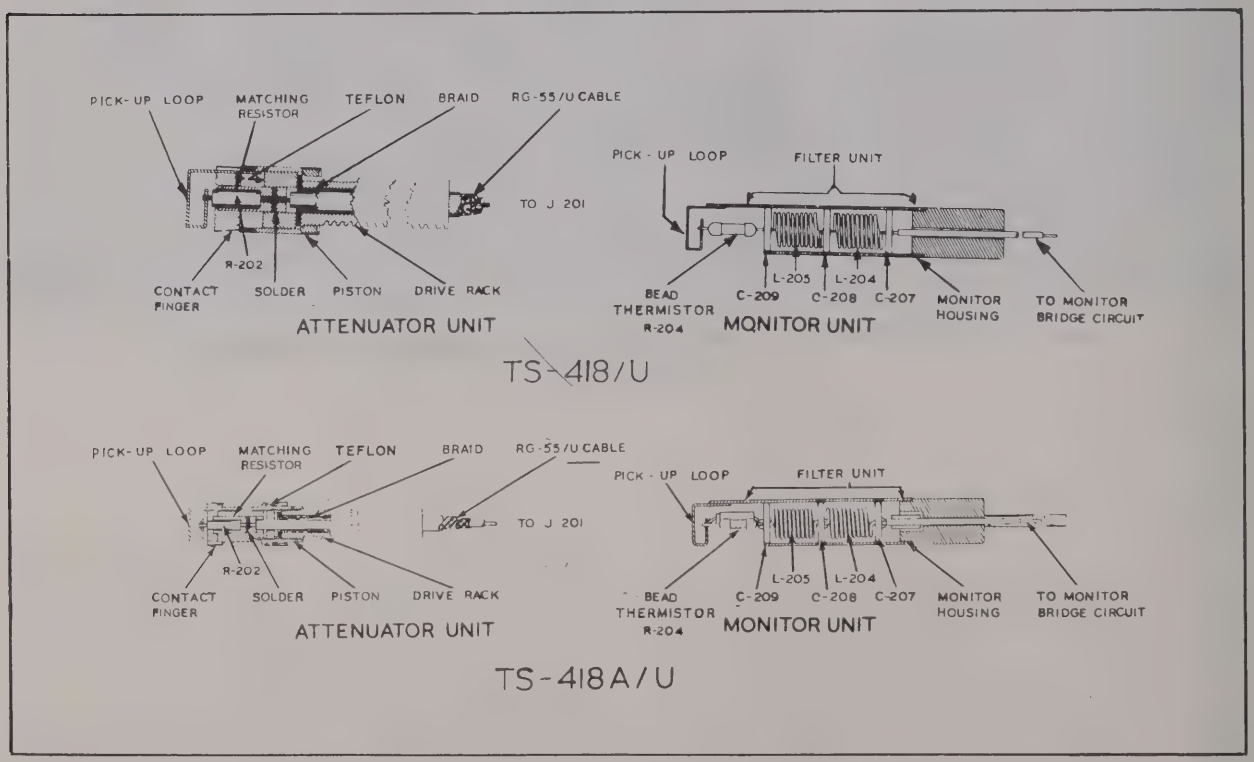


Figure 5-6. Cutaway View of Monitor and Attenuator Units

SECTION VI

TABLE OF REPLACEABLE PARTS

1. GENERAL.

The pages of this section of the instruction manual contain a Table of Replaceable Parts for Signal Generator TS-418/U together with additional parts data such as capacitor and resistor color codes.

The Table of Replaceable Parts does not consist of a thorough listing of all parts in the instrument; rather, the Table lists such parts as are reasonably subject to failure and thus eventual replacement. This method will be found to be especially applicable to the parts in the RF oscillator assembly. Only such parts of this system as are subject to replacement are listed in the Table.

The Table of Replaceable Parts consists of two sections: the greater portion of the Table consists of a list of parts of the signal generator. This list is followed by a list of the accessories and spares which are provided with the signal generator. In both lists the parts are listed in the alphabetical and numerical order of their reference symbols.

The second column of the table gives the Air Force, Navy, and Army stock numbers for the various parts. The first number listed for the part is the Air Force stock number, the second number being the Navy stock number, while the last number is the Army stock number. Not all of the parts have all three stock numbers and some of the parts have no number. Where one or two of the part numbers is missing a straight line is substituted, this being done to preserve the identity of the listed part number or numbers.

*Items starred are parts used with Signal Generator TS-418A/U only.

††When appearing before reference symbol see Paragraph 16 of Section IV.

2. ORDERING OF SPARE PARTS.

a. Each Service using this list has established certain depots and service groups for the storage and issue of spare parts to its organizations requiring them. The regulations of each Service should be studied to determine the method and source for requisitioning spare parts. The information in this list, as to manufacturer's or contractor's name, type, model or drawing number, is not to be interpreted as authorization to field agencies to attempt to purchase identical or comparable spare parts direct from the manufacturer or a wholesale or retail store except under emergency conditions as covered by existing regulations of the Service concerned.

b. U. S. ARMY PERSONNEL: This table is for information ONLY and is not to be used as a basis for requisitioning parts. Authorities for obtaining maintenance items are as follows: 1. For using organizations; applicable Service publications of the 00-30 series of AF Technical Orders. 2. For higher maintenance and supply echelons; the applicable Standard Maintenance List.

c. Where no JAN or Navy standard part number is given to a component, care should be taken in replacing the component with any other part than that listed in Table of Replaceable Parts. This special part probably has been chosen for a special quality not available in standard components, and use of a standard component may result in decreased life or lowered performance.

3. REFERENCE SYMBOLS.

a. The reference symbols shown in the Table of Replaceable Parts are the same as those used in the schematic diagram of the circuit and of the practical wiring diagram for Signal Generator TS-418/U. Each reference symbol consists of a letter followed by a three-digit number. The letter indicates the type of component or apparatus as explained below:

Reference Symbol Letters

Letter	*Type of Component*
C	Capacitor
E	Miscellaneous Electrical Parts
F	Fuse
H	Hardware
I	Indicating Device
J	Jack
L	Reactor
M	Meter
O	Mechanical Parts
P	Plug
R	Resistor
S	Switch
T	Transformer
V	Vacuum Tube
W	Cable
X	Socket
Z	Impedance

b. The numerical portion of the reference symbol is assigned on the basis of the circuit in which it is located, as shown below:

Series	*Circuit*	*Page*
101-199	Power Supply	6-9
201-299	RF Oscillator	6-14
301-399	Pulse Generator and Modulator	6-24

4. ABBREVIATIONS USED IN TABLE.

AM	amplitude modulation
amp	ampere(s)
approx	approximate or approximately
atten	attenuator
AWG	American Wire Gauge
AWS	American War Standard
C	degrees Centigrade
cad	cadmium
coef	coefficient
cont	contract(s), contractor
cps	cycles per second
CT	center tap or center tapped
c to c	center to center
CW	continuous wave
d	depth or deep
db	decibel(s)
dbm	decibel(s) with reference to one milliwatt
DC	direct current
deg	degree(s)
desig	designation
diam	diameter(s)
DPDT	double pole, double throw
dwg	drawing(s)
ea	each
ext	external
F	degrees Fahrenheit
FM	frequency modulation
freq	frequency(ies)
ga	gauge
gnd	ground(ed)
gov	government
h	height or high
hex	hexagon or hexagonal
HS	hermetically sealed
hy	henry(s)
ID	inside diameter(s)
incl	includes, included, inclusive, including
int	internal
JAN	Joint Army-Navy
lg	length or long
ma	milliampere(s)
mach	machine
max	maximum
mc	megacycle
med	medium
meg	megohm(s)
mf	microfarad(s)
mfr	manufacturer(s)
min	minimum
mmf	micromicrofarad(s)
mod	modulator
mt	mount
mtd	mounted
mtg	mounting
mtg c	mounting center(s)
mts	mounts
mv	millivolt(s)
mw	milliwatt(s)
neg	negative
no	number
OD	outside diameter(s)
oper	operating
oz	ounce(s)
PD	pitch diameter
ph	phase
pl	plated
p/o	part of
pos	positive
pps	pulses per second
pr	pair(s)
pt	point
ref	reference(s)
reqd	required
rev	revised, revision
RF	radio frequency
RHMS	round-head machine screw
RMS	root mean square
sec	second(s)
secd	secondary(ies)
SPDT	single-pole, double-throw
spec	specification(s)
sync	synchronous
temp	temperature
term	terminal(s)
thd	thread(s)
thk	thick or thickness
tol	tolerance
UHF	ultra-high-frequency
u sec	microsecond(s)
uv	microvolt(s)
u/w	used with
v	volt(s)
vdcw	volts DC working
w	watt(s)
w	with
wd	wide or width
x	by (as used to express dimensions)

TABLE 6-1. LIST OF MANUFACTURERS

ABBREVIATION	NAVY TYPE PREFIX	NAME	ADDRESS
Transitron	CBZU	Transitron Inc.	New York 12, N. Y.
Lavoie Lab	CAJR	Lavoie Labs.	Morganville, N. J.
		Aerovox Corp.	New Bedford, Mass.
AB	CBZ	Allen-Bradley Co.	Milwaukee 4, Wis.
		Amalgamated Electronics	Quinton Corners, N. Y.
AH&H		Arrow-Hart & Hegeman	Hartford 6, Conn.
		Atlantic India Rubber	Chicago, Ill.
	CAIS	Birtcher Corp.	Los Angeles 32, Calif.
Buss	CFA	Bussman Mfg. Co.	St. Louis, Mo.
Cinch	CMG	Cinch Mfg. Corp.	Chicago 12, Ill.
ConCarb		Continental Carbon Co.	Cleveland 11, Ohio
		Cornell Dubilier	South Plainfield, N. J.
Dialco	CAYZ	Dial Light of America Inc.	New York 5, N. Y.
		Diamond Instrument	Wakefield, Mass.
Eby		Hugh H. Eby, Inc.	Philadelphia 44, Pa.
ERC		Erie Resistor Corp.	Erie, Penna.
		John Fast Co.	Chicago 41, Ill.
		Federal Telephone & Radio Corp.	East Newark, N. J.
Freed		Freed Transformer Co., Inc.	Brooklyn, N. Y.
GE	CG	G. E. Tube Division	Schenectady, N. Y.
Harry Davies Mold		Harry Davies Molding Co.	1428 N. Wills, Chicago 10,
Hub	CHU	Harvey Hubbell, Inc.	Bridgeport 2, Conn.
		Hytron Corporation	Salem, Mass.
IPC		Industrial Products	Danbury, Conn.
IRC	CIR	International Resistance Company	Philadelphia, Penna.
		Kings Electronics	Brooklyn, N. Y.
KK		Kurz-Kasch, Inc.	Dayton, Ohio
LTF	CLF	Littlefuse, Inc.	Chicago 40, Ill.
Marion	CMY	Marion Electrical Instruments	Manchester, N. H.
		Micamold	Brooklyn 6, N. Y.
Oak	COC	Oak Mfg. Co.	Chicago 10, Ill.
		RCA Mfg. Co.	Harrison, N. J.
SPR		Sprague Electrical Co.	North Adams, Mass.
Syl		Sylvania Electric Products	New York 18, N. Y.
		Tobe Deutschmann	Canton, Mass.
		Ucinite Co.	Newtonville, Mass.
VECO		Victory Engineering Co.	Union, N. J.
WECo	CW	Western Electric Co.	New York, N. Y.

5. LIST OF MANUFACTURERS.

A list of manufacturers of replaceable parts appearing in table 6-1 is included in this section. The first column shows the abbreviations used in the table. The second column gives the Navy Type-Number Prefix which is sometimes used as a prefix for Navy Type Designations. The manufacturer's full name and address are listed in the third and fourth columns of the list.

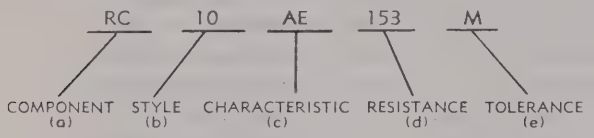
6. RESISTOR AND CAPACITOR COLOR CODES.

Resistors and capacitors which are manufactured in accordance with Joint Army-Navy standards are identified by a designation consisting of a series of letters and numbers. This designation is known as the JAN designation and identifies the component completely as to electrical and mechanical characteristics. On small parts such as mica capacitors and composition resistors it is impractical to place the JAN designation on the

component because of the small physical size of the component. On such components a color code is used to identify the item as to its JAN characteristics. Explanations of the standard color codes and of the type designations for fixed composition resistors per JAN-R-11, power type fixed wirewound resistors per JAN-R-26, fixed mica-dielectric capacitors per JAN-C-5, and fixed paper-dielectric capacitors per JAN-C-25 are given below as paragraphs *6a*, *6b*, *6c*, and *6d*.

a. FIXED COMPOSITION RESISTORS PER JAN-R-11.

(1) Type Designation.—The type designation of fixed composition resistors is formed as follows:



(a) COMPONENT.—The first symbol of the type designation is a two-letter symbol which identifies the part as a fixed composition resistor. "R" stands for resistor and "C" distinguishes the sub-class of composition resistor.

(b) STYLE.—The style is identified by a two-digit symbol which distinguishes the resistor as to power rating, physical shape, and size.

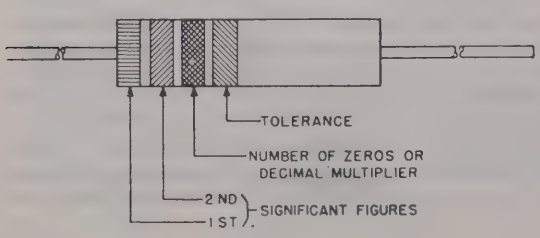
(c) CHARACTERISTIC.—The two-letter symbol following the style symbol indicates the type of insulation and resistance characteristics of the resistor in accordance with Specification JAN-R-11.

(d) RESISTANCE.—The nominal resistance value of the resistor is identified by a three-digit symbol which follows the characteristic symbol. The first two digits of the resistance symbol are the first two figures of the resistance value in ohms. The final digit specifies the number of zeros which follow the first two figures.

(e) RESISTANCE TOLERANCE.—The final letter of the type designation is a single letter which denotes the symmetrical tolerance in percent of the resistor in accordance with the following code:

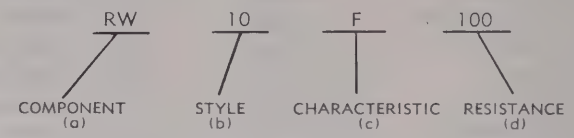
Letter	*Tolerance*
J	± 5 percent
K	± 10 percent
M	± 20 percent

(2) COLOR CODE.—The color code used for fixed composition resistors manufactured in accordance with JAN-11 is shown below.



b. POWER TYPE FIXED WIRE-WOUND RESISTORS PER JAN-R-26.

(1) TYPE DESIGNATION.—The type designation of power-type fixed wire-wound resistors is formed as follows:



(a) COMPONENT.—The first symbol of the type designation consists of a two-letter symbol which identifies the part as a power-type fixed wire-wound resistor. The letter "R" signifies a resistor and the letter "W" denotes the sub-class of power-type fixed wire-wound resistors.

(b) STYLE.—The second symbol of the type designation consists of a two-digit symbol which identifies the resistor as to physical shape, size, and power rating, in accordance with the standards of Specification JAN-R-26.

(c) CHARACTERISTIC.—The third symbol of the type designation is a single letter which identifies the class, grade, and high ambient temperature derating of the resistor in accordance with the standards of Specification JAN-R-26.

(d) RESISTANCE.—The last symbol of the type designation is a three-digit symbol which identifies the resistance value in ohms of the resistor. The first two digits of the symbol are the first two numbers of the resistance, while the third digit indicates the number of zeros which follow the first two numbers. The letter "R" may be substituted for one of the digits to represent the decimal point, but when "R" is used, the last figure of the group becomes significant as in the following example:

2R 2.5 ohms

(2) COLOR CODE.—No color is used to identify power-type fixed wire-wound resistors. Instead, the JAN type designation is imprinted on the body of the resistor.

c. VARIABLE, WIRE-WOUND RESISTORS

(1) TYPE DESIGNATION.—The type designation of variable wire-wound resistors is formed as follows:

(a) COMPONENT: RA signifies *variable, wire-wound resistor.*

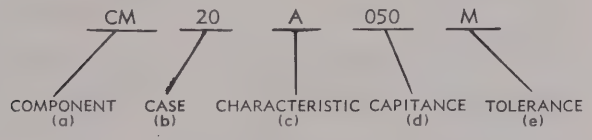
(b) STYLE: A two-digit symbol indicates power rating and physical size and shape.

(c) SWITCH: Symbol A indicates no switch. Symbol B indicates a switch turned ON at start or clockwise rotation.

(d) RESISTANCE: A three-digit symbol indicates the resistance value in ohms. The first two digits give the first two figures of the resistance value; the final digit gives the number of zeros which follow the first two figures. The letter *R* may be substituted to represent a decimal point; but when *R* is used, the last digit of the group becomes significant.

d. FIXED MICA-DIELECTRIC CAPACITORS PER JAN-C-5.

(1) TYPE DESIGNATION.—The type designation for fixed mica-dielectric capacitors is formed as follows:



(a) COMPONENT.—Fixed mica-dielectric capacitors are identified by the first two letters of the type designation "CM." "C" stands for capacitor and "M" distinguishes the sub-class of mica-dielectric capacitors.

(b) CASE.—The second symbol of the type designation is a two-digit symbol which distinguishes the capacitor as to case size and shape in accordance with the standards set out in JAN-C-5.

(c) CHARACTERISTIC.—The third symbol of the type designation is a single letter which distinguishes the capacitor as to temperature coefficient, capacity drift, etc., in accordance with the standards of Specification JAN-C-5.

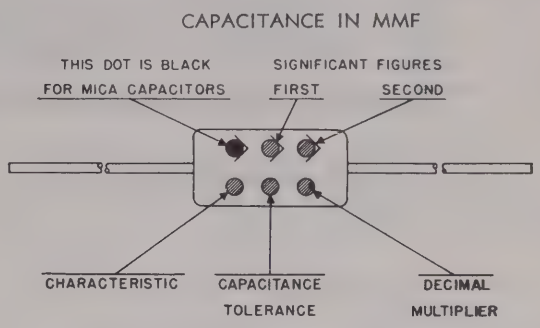
(d) CAPITANCE.—The fourth symbol of the type designation is a three-digit symbol which identifies the capacitance of the capacitor. The first two digits are the first two digits of the capacitance of the capacitor in micromicrofarads. The third digit specifies the number of digits which follow the first two digits. When more than two significant figures are required, additional digits may be used, the last digit always indicating the number of zeros.

(e) CAPITANCE.—The final letter of the type designation identifies the symmetrical capitance tolerance in percent in accordance with the following code:

Letter	*Tolerance*
G	± 2 percent
J	± 5 percent
K	± 10 percent
M	± 20 percent

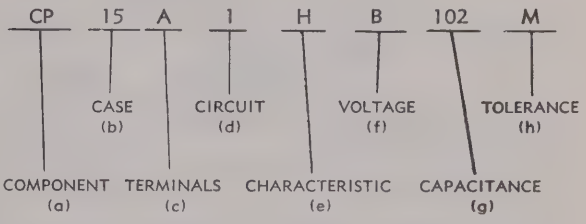
In no case is the tolerance less than one micromicrofarad.

(2) COLOR CODE.—The color code used for fixed mica-dielectric capacitors manufactured in accordance with Specification JAN-C-5 is shown below.



e. FIXED PAPER-DIELECTRIC CAPACITORS PER JAN-C-25.

(1) TYPE DESIGNATION.—The type designation of fixed, paper-dielectric, direct-current capacitors which are hermetically sealed in metal cases is formed as follows:



(a) COMPONENT.—The first symbol of the type designation consists of a two-letter symbol which identifies the part as a paper-dielectric capacitor. The "C" stands for capacitor and the "P" distinguishes the subclass of paper-dielectric capacitors.

(b) CASE.—The second symbol of the type designation is a two-digit symbol which identifies the case size of the capacitor in accordance with the sizes established by Specification JAN-C-25.

(c) TERMINALS.—The third symbol of the type designation is a single letter which identifies the type of terminals on the capacitor in accordance with the definitions set up in JAN-C-25.

(d) TERMINALS AND CIRCUIT.—The fourth symbol of the type designation is a single digit which identifies the number of terminals and the circuit diagram of the capacitor in accordance with the definitions of Specification JAN-C-25.

(e) CHARACTERISTICS.—The fifth symbol of the type designation is a single letter which identifies the temperature characteristics of the capacitor according to the standards of Specification JAN-C-25.

(f) VOLTAGE.—The sixth symbol of the type designation is a single letter which denotes the direct-voltage rating of the capacitor according to the standards of Specification JAN-C-25.

(g) CAPITANCE.—The seventh symbol of the type designation is a three-digit number which identifies the capacitance value of the capacitor. The first two digits represent the first two figures of the capaci-

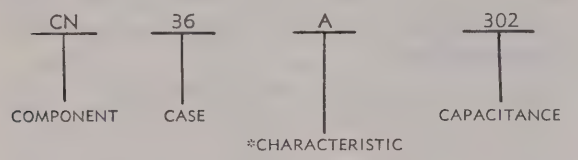
tance value in micromicrofarads. The third digit indicates the number of zeros which follow.

(h) CAPITANCE TOLERANCE.—The last symbol of the type designation is a single letter which indicates the capacitance tolerance in percent according to the standards of Specification JAN-C-25.

(2) COLOR CODE.—No color code is used to identify fixed, paper-dielectric capacitors that are hermetically-sealed in metal cases. Instead, the JAN type designation is imprinted on the capacitor.

f. FIXED, MOLDED, PAPER-DIELECTRIC CAPACITORS.

(1) TYPE DESIGNATION.—The type designation of fixed, molded, paper-dielectric capacitors is formed as follows:



(a) COMPONENT: CN signifies *fixed, molded, paper-dielectric capacitor.*

(b) CASE: Same as for fixed, mica-dielectric capacitors.

(c) CAPACITANCE: A three-digit symbol indicates the capacitance value in micromicrofarads. The first two digits give the first two figures of the capacitance value: the third digit gives the number of zeros which follow the first two figures.

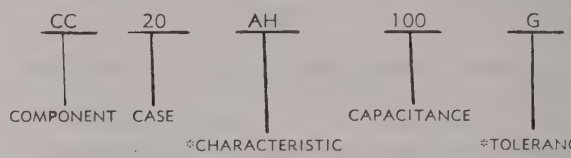
D-C WORKING VOLTAGE FOR CAPACITANCE RANGE

Case	Capacitance	Vdcw
CN35	3,000 mmf	800
	6,000 mmf	600
	10,000 mmf	400
CN36	3,000 mmf	400
	6,000 mmf	400
	10,000 mmf	300
CN40	3,000 mmf	400
	6,000 mmf	300
	10,000 mmf	300
CN41	3,000 mmf	600
	6,000 mmf	600
	10,000 mmf	400

The d-c working voltage of a capacitor can be determined from the above table when the case size and value of capacitance are known.

g. FIXED, CERAMIC-DIELECTRIC CAPACITORS.

(1) TYPE DESIGNATION.—The type designation of fixed, ceramic-dielectric capacitors is formed as follows:



(a) COMPONENT: CC signifies *fixed, ceramic-dielectric capacitor.*

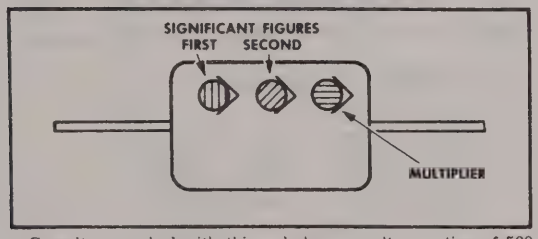
(b) CASE: Same as for fixed, mica-dielectric capacitors.

(c) CAPACITANCE: Same as for fixed, molded, paper-dielectric capacitors.

NOTE: All fixed, ceramic-dielectric capacitors have a working voltage of 500 volts, d-c.

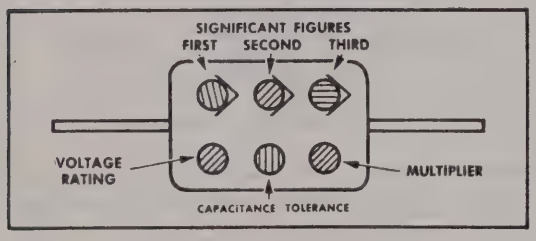
CAPACITOR COLOR CODES

RMA 3-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS

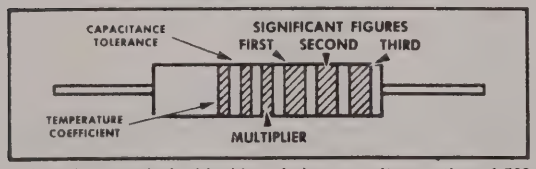


Capacitors marked with this code have a voltage rating of 500 volts.

RMA 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



RMA COLOR CODE FOR TUBULAR CERAMIC-DIELECTRIC CAPACITORS

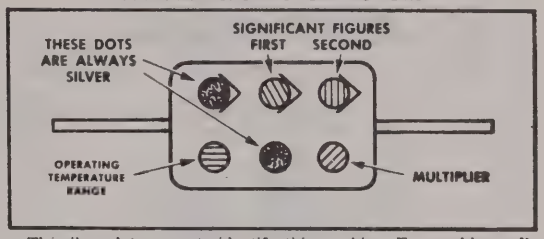


Capacitors marked with this code have a voltage rating of 500 volts.

RMA Radio Manufacturers Association JAN Joint Army-Navy

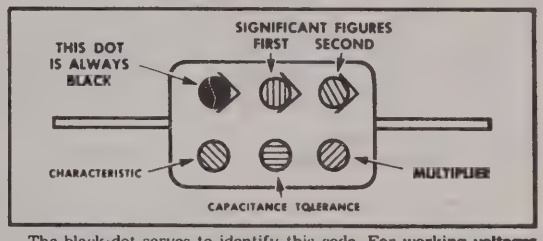
Note These color codes give all capacitances in micromicrofarads.

JAN 6-DOT COLOR CODE FOR PAPER-DIELECTRIC CAPACITORS



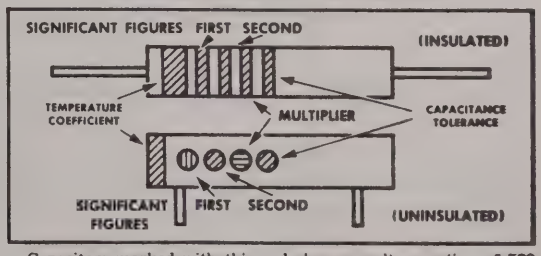
The silver dots serve to identify this marking. For working voltages see JAN type designation code.

JAN 6-DOT COLOR CODE FOR MICA-DIELECTRIC CAPACITORS



The black-dot serves to identify this code. For working voltages see JAN type designation code.

JAN COLOR CODE FOR FIXED CERAMIC-DIELECTRIC CAPACITORS

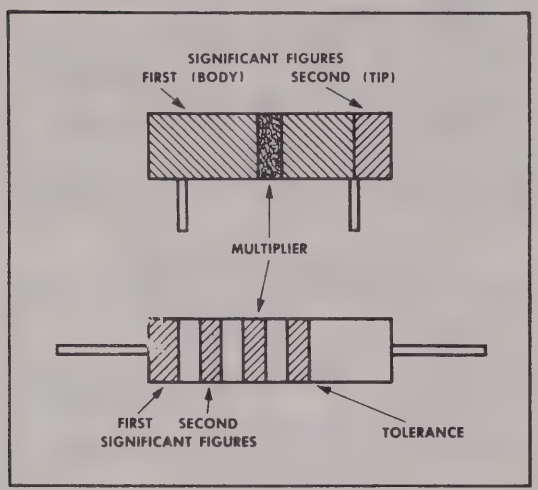


Capacitors marked with this code have a voltage rating of 500 volts. Either the band or dot code may be used.

COLOR	SIGNIFICANT FIGURE	MULTIPLIER			RMA VOLTAGE RATING
		RMA MICA-AND CERAMIC-DIELECTRIC	JAN MICA-AND PAPER-DIELECTRIC	JAN CERAMIC-DIELECTRIC	
BLACK	0	1	1	1	
BROWN	1	10	10	10	100
RED	2	100	100	100	200
ORANGE	3	1,000	1,000	1,000	300
YELLOW	4	10,000			400
GREEN	5	100,000			500
BLUE	6	1,000,000			600
VIOLET	7	10,000,000			700
GRAY	8	100,000,000		0.01	800
WHITE	9	1,000,000,000		0.1	900
GOLD		0.1	0.1		1,000
SILVER		0.01	0.01		2,000
NO COLOR					500

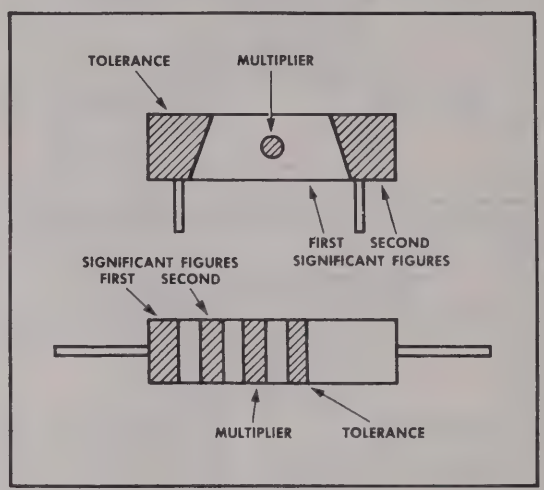
RESISTOR COLOR CODES

RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS



Insulated fixed composition resistors with axial leads are designated by a natural tan background color. Non-insulated fixed composition resistors with axial leads are designated by a black background color.

JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS



Resistors with axial leads are insulated. Resistors with radial leads are uninsulated.

COLOR	SIGNIFICANT FIGURE	MULTIPLIER	TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	
RED	2	100	
ORANGE	3	1,000	
YELLOW	4	10,000	
GREEN	5	100,000	
BLUE	6	1,000,000	
VIOLET	7	10,000,000*	
GRAY	8	100,000,000*	
WHITE	9	1,000,000,000*	
GOLD		0.1*	5
SILVER		0.01*	10
NO COLOR			20

*JAN ONLY

Example: A 50,000-ohm resistor with a standard tolerance of 20 percent (no color) would be indicated by a green ring (5), a black ring (0), and an orange ring (000)

RMA: Radio Manufacturers Association
JAN: Joint Army-Navy

TABLE 6-1.—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
101-399	1600-329002300 R16-AN-TS-418/U 3F4325-418	GENERATOR, RF signal: Army-Navy Signal Generator TS-418/U; AM and pulse, CW; 400 to 1000 mc in one band; metal case; 17⅜" wd x 12⅜" h x 14$^{21}/_{32}$" d o/a; 1% accuracy; internal pulse modulation; can be modulated externally by AM or pulse; output meter calibrated in db; 115 V, 50 to 1600 cps single phase; accessories are Case CY-741/U, 1 ea RF Cable CG-546/U (6'), 2 ea RF Cable CG-546/U (8'), 3 ea Adapter UG-201/U, 3 ea Adapter UG-255/U, 3 ea Adapter UG-273, 1 ea Power Cord CX-337/U (6'), 3 ea Lamps Mazda #47, 3 ea Fuses Bussman 3AG-3 amp, 1 ea Thermistor WECO D-166382, 1 ea Thermistor WECO D-168392, 1 ea Thermistor WECO D-168391.	Signal source 400 to 1000 mcs for receiver measurements and other applications that require less than 1 milliwatt of CW, amplitude mod; or pulse mod RF signals.	Lavoie Lab 1367200	Bureau of Aeronautics specification 16G6 (AER)
101-399	R16-AN-TS-418A/U	GENERATOR, RF signal: Army-Navy Signal Generator TS-418A/U; AM and pulse, CW; 400 to 1000 mc in one band; metal case; 17⅜" wd x 12⅜" h x 14$^{21}/_{32}$" d o/a; 1% accuracy; internal pulse modulation; can be modulated externally by AM or pulse; output meter calibrated in db; 115 V, 50 to 1600 cps single phase; accessories are Case CY-741/U, 1 ea RF Cable CG-546/U (6'), 2 ea RF Cable CG-546/U (8'), 3 ea Adapter UG-201/U, 3 ea Adapter UG-255/U, 3 ea Adapter UG-273, 1 ea Power Cord CX-337/U (6'), 3 ea Lamps Mazda #47, 3 ea Fuses Bussman 3AG-3 amp, 1 ea Thermistor WECO D-166382, 1 ea Thermistor WECO D-168392, 1 ea Thermistor WECO D-168391; similar to Signal General TS-418/U except for addition of cavity, shield and filters.	Signal source 400 to 1000 mcs for receiver measurements and other applications that require less than 1 milliwatt of CW, amplitude mod; or pulse mod RF signals.	Lavoie Lab E-1367550	Bureau of Aeronautics specification 16G6 (AER)
		POWER SUPPLY CIRCUIT			
C-101	3300-317094652 R16-C-11493-605 3DB2-74	CAPACITOR, fixed: paper 2 mf ±10%; 1000 vdcw; HS metal case; 4½" h x 1½" diam; oil filled and impr; two solder lug term on end; #¾"-16 mtg stud	Filter element for +400V supply	JAN CP41B1DG205K	JAN-C-25
C-102		CAPACITOR, fixed: same as C-101	Same as C-101		
C-103	3300-317642959 R16-C-11599-27-5 3DB4-224	CAPACITOR, fixed: paper; 4 mf ±10%; 600 vdcw; HS metal case; 4½" h x 1½" diam; oil filled and impr; two solder lug term on end; #¾"-16 mtg stud	Same as C-101	JAN CP41B1DF405K	JAN-C-25
C-104		CAPACITOR, fixed: same as C-103	Same as C-101		
C-105		CAPACITOR, fixed: same as C-103	Filter element for +300V supply		
C-106		CAPACITOR, fixed: same as C-103	Filter element for —200V supply		
C-107		CAPACITOR, fixed: same as C-103	Same as C-106		
C-108	3300-316777466 R16-C-11179-30 3DA100-596	CAPACITOR, fixed: paper; 100,000 mmf ±10%; 600 vdcw; HS metal case; 2$^{1}/_{16}$" lg x $^{1}/_{16}$" diam; oil filled and impr two axial wire leads; single hole mtg clamp.	Couples V-103 video amplifier plate to grid of V-104	JAN CP28A1EF104K	JAN-C-25

TABLE 6-1.—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
C-109	3300-319001041 R16-C-11354-24 3DA500-468	CAPACITOR, fixed: paper; 500,000 mmf ±10%; 600 vdcw; 1 13/16" lg x 1" wd x 7/8" thk; HS metal case; oil filled and impr; two solder lug term located on side; two 3/16" diam mtg holes on 2 1/8" mtg ctr	Couples ripple voltage to grid of V-105 Prevents change in potentials of grid of V-105	JAN CP53B1FF504K	JAN-C-25
E-101	3300-387257555 3Z770-24.5	BOARD, terminal: resistor binding post strip; 12 pr solder lug term, brass, silver; 9 pr on 1 7/8" centers; 3 pr on 1 3/8" centers; bakelite; 5 1/4" lg x 2 1/2" wd x 1/8" thk; two .147 diam mtg holes on 3 1/8" mtg/c	To support circuit components R-101, R-103, R-104, R-105, R-106, R-107, R-108, R-109, R-113, R-114, R-117, R-118	Lavoie Lab B-1367353	Lavoie Lab Dwg B-1367353
E-102	3300-387256369 3Z770-6.19	BOARD, terminal: resistor binding post strip; six solder lug term, brass, silver pl; two pr on 3 1/2" centers, one pr on 2 1/2" centers; bakelite; 4 1/4" lg x 2 1/2" wd x 1/8" thk; two .120 diam mtg holes on 3 1/2" x 7/8" centers; bakelite plate 1/32" thk mtd on back, metal clamp for holding resistors	To support circuit components R-110, R-111, R-112	Lavoie Lab B-1367357	Lavoie Lab Dwg B-1367357
E-103	3300-387256371 3Z770-6.21	BOARD, terminal: resistor binding post strip; six solder lug term, brass, silver pl; three pr on 2 1/2" centers; bakelite; 3 1/4" lg x 2 1/2" wd x 1/8" thk; two .120 diam mtg holes on 1 3/4" x 7/8" centers; bakelite plate 1/32" thk mtd on back, metal clamp for holding resistors	To support circuit components R-102, R-115, R-116	Lavoie Lab B-1367362	Lavoie Lab Dwg B-1367362
E-104	3300-295580677 R16-S-3934 2Z8320-13	SHIELD, tube: aluminum; cylindrical; twist lock mtg; .941" diam x 1 3/4" h	Tube shield for V-103	JAN S0S6	JAN-S-28
E-105	3300-295578675 R16-S-3932-800 2Z8304.57	SHIELD, tube: aluminum; cylindrical; twist lock mtg; .941" diam x 1 3/8" h	Shield for V-105	JAN S0S3	JAN-S-28
E-106	3300-295578954 R16-S-3934-5 3Z8304.131	SHIELD, tube: aluminum; cylindrical; twist lock mtg; .941" diam x 2 1/4" h; steel cad plated	Shield for V-106	Eby 8694	
E-107	8800-444200 17-L-6305 2Z5927	LAMP, incandescent: Army-Navy Type #TB-11, 6-8 v, 0.25 amp; T 3 1/4 clear bulb; 1 1/8" lg; miniature bayonet base; C-2R tungsten fil; burn any position	Indicates heaters on	Mazda 44	
E-108	8800-444163 17-L-6297 2Z5952	LAMP, incandescent: Army-Navy Type #TB-14; 6-8 v, 0.15 amp; T 3 1/4 clear bulb; 1 1/8" lg; miniature bayonet base; C-2R tung fil burn any position	Indicates power on	Mazda 47	
E-109	8800-619655 R17-P-7194-50	HOLDER, fuse: extractor post type; for one 3AG fuse; black bakelite body; 250 V, 15 amp max; 11/16" diam x 2" lg; 1/4-24 thd body for panel mtg; 2 solder lug term	For fuse F-101	Bussman HKP-H	
E-110		HOLDER, fuse: same as E-109	For F-102		
E-111		HOLDER, fuse: same as E-109	For F-103		
E-112		HOLDER, fuse: same as E-109	For F-104		

E-113		BOARD, terminal: resistor binding post strip; four solder lug term; brass, silver; two pr at 3½" centers; bakelite; 4¼" lg x 2" wd x ⅛" thk; three .147" diam mtg holes on 1⅛" centers; tow outside holes csk	To support circuit components R-119, R-120	Lavoie Lab B-1367348	Lavoie Lab B-1367348
F-101	8800-361212 R17-F-16310 3Z1950	FUSE, cartridge: Sig C FU-50; 3 amp, indefinite blowing time at 110% load, 1 hr blowing time at 135% load, 2 min blowing time at 200% load; 250 V; one time; glass body; ferrule term; 1¼" lg x ¼" diam	3 amp AC line fuse	Bussman 3AG-3Amp	
F-102		EUSE, cartridge: same as F-101	Same as F-101		
F-103		FUSE, cartridge: same as F-101	Spare fuse		
F-104		FUSE, cartridge: same as F-101	Spare fuse		
I-101	8800-529142-5 R17-L-12930-77	LIGHT, indicator: w/lens; ½" diam white frosted lens; T-3¼ bulb; encl shell; brass shell, black lacquer finish; 2⅜" lg x ⅞" diam; 1 1/16" diam mtg hole; horiz mtd, lamp replaceable from front; threaded jewel; two solder lug term on end; mechanical dimmer	For lamp E-107	Dialco 832210-117	
I-102	8800-529202-685 R17-L-12930-76	LIGHT, indicator: w/lens; ½" diam red frosted lens; T-3¼ bulb; encl shell; brass shell, black lacquer finish; 2⅜" lg x ⅞" diam; 1 1/16" diam mtg hole; horiz mtd, lamp replaceable from front; threaded jewel; two solder lug term on end; mechanical dimmer	For lamp E-108	Dialco 832210-111	
J-101	8850-494340 R17-R-2029-20	CONNECTOR, receptacle: two flat parallel blades; straight type; 1¼" lg x 1½" d; black molded bakelite body; two .156" mtg holes on 1.937" mtg/c	Connects to P-101	Hubbell 4891	
L-101A L-101B	3300-310201250 R16-R-1649 3C323-197A	REACTOR: filter choke; dual; Sect #1, 10 hy, 125 ma, Sect #2, 10 hy, 75 ma; Sect #1, 160 ohms DC resistance at 25°C, Sect #2, 265 ohms DC resistance at 25°C; 600 V RMS test; HS metal case; 5½" h x 3 9/16" wd x 2⅞" thk, o/a; four #10-32 x ½" spade bolts on 2½" mtg/c; four solder lug term on stand-off ins 1¼" c to c on top of case	Filter element for —200V supply Filter element for +400V supply	Lavoie Lab B-1367047	Lavoie Lab Dwg B1367047
O-101	3300-287172845 R16-C-19582 2Z2636-26	CLIP: tube retaining; for holding tube in place; SS; 1 5/16" diam x ⅞" h; 1 7/16" diam max opening; incl mtg bracket w/elongated hole for #10 mtg screw	Lock for tube V-102	Birtcher 926 C	
O-102	3300-291697089 R16-C-19628 2Z5042-4	CLIP: tube retaining for holding tube in place; SS; 1 5/16" diam x ⅞" h; 1 5/16" diam max opening; incl mtg bracket w/elongated hole for #10 mtg screw	Lock for tube V-101	Birtcher 926 B	
O-103		RETAINER, tube: same as O-101	Lock for V-104		
O-104	8800-117830 R17-C-2665	CAP: fuseholder cap; p/o Bussman Fuseholder HKP-H; black molded phenolic; ¾" lg x 1 1/16" diam; twist lock type mtg; marked "Fuse" and w/counter clockwise arrow; rubber gasket ⅝" OD x ⅜" ID; hole for test prod in ctr of cap	Cover for E-109	Bussman HKP-H9758½	
O-105		CAP, fuseholder: same as O-104	Cover for E-110		
O-106		CAP, fuseholder: same as O-104	Cover for E-111		
O-107		CAP, fuseholder: same as O-104	Cover for E-112		

TABLE 6-1.—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
R-101	3300-381367200 R16-R-17349-15-500 3RC31BF154K	RESISTOR, fixed: comp; 150,000 ohms ±10%; 1 w; 1.28" lg x .310" diam; two axial wire leads	Bleeder for —200V supply	JAN RC31BF154K	JAN-R-11
R-102	3300-385291090 R16-R-18681-14-250 3RW29109	RESISTOR, fixed: ww; 6300 ohms ±5%; 9 w; 2" lg x ½" diam; ins; inductive; two solder lug term	Filter element for +300V supply	JAN RW51J632	JAN-R-26
R-103	3300-381519740 R16-R-17281-179-500 3RC40BF472K	RESISTOR, fixed: comp; 4700 ohms ±10%; 2 w; 1.78" lg x .405" diam; two axial wire leads	Load resistor for V-103	AB HB4721	
R-104		RESISTOR, fixed: same as R-103	Same as R-103		
R-105		RESISTOR, fixed: same as R-103	Same as R-103		
R-106		RESISTOR, fixed: same as R-103	Same as R-103		
R-107		RESISTOR, fixed: same as R-103	Same as R-103		
R-108	3300-381219860 R16-R-17354-14-202 3RC21BF474K	RESISTOR, fixed: comp; 470,000 ohms ±10%; ½ w; .655" lg x .249" diam; two axial wire leads	Grid resistor for V-103	JAN RC21BF474K	JAN-R-11
R-109	3300-381218000 R16-R-17262-55-53 3RC21BF221K	RESISTOR, fixed: comp; 220 ohms ±10%; ½ w; .655" lg x .249" diam; two axial wire leads	Provides Grid cathode bias	JAN RC21BF221K	JAN-R-11
R-110	3300-385267490 R16-R-18675-655 3RW26749	RESISTOR, fixed: ww; 2500 ohms ±5%; 19 w; 2⅞" lg x 19/32" diam; ins; inductive; two solder lug term	Determines potential of V-105	JAN RW52J252	JAN-R-26
R-111		RESISTOR, fixed: same as R-110	Same as R-110		
R-112	3300-385261390 R16-R-18663-90 3RW26139	RESISTOR, fixed: ww; 2000 ohms ±5%; 9 w; 3" lg x 1⅓" diam; ins; inductive; two solder lug term	Dropping resistor for V-106	JAN RW51J202	JAN-R-26
R-113	3300-381366160 R16-R-17310-8 3RC31BF103K	RESISTOR, fixed: comp; 10,000 ohms ±10%; 1 w; 1.28" lg x .310" diam; two axial wire leads	Determines cathode voltage of V-105	JAN RC31BF103K	JAN-R-11
R-114		RESISTOR, fixed: same as R-113	Same as R-113		
R-115		RESISTOR, fixed: same as R-102	Bleeder for regulated supply		
R-116		RESISTOR, fixed: same as R-102	Same as R-115		
R-117	3300-381220700 R16-R-17364-5 3RC21BF684K	RESISTOR, fixed: comp; 680,000 ohms ±10%; ½ w; .655" lg x .249" diam; two axial wire leads	Maintains grid potential of V-104	JAN RC21BF684K	JAN-R-11

R-118	3300-385279140 R16-R-18679-20-250 3RW27914	RESISTOR, fixed: ww; 4000 ohms ±5%; 5 w; 2 5/16" lg x 3/8" diam; ins; inductive; two solder lug term	Provides voltage regulation with V-107	JAN RW50J402	JAN-R-26
R-119	3300-385249090 R16-R-18658-274 3RW24909	RESISTOR, fixed: ww; 1200 ohms ±5%; 19 w; 2 7/8" lg x 19/32" diam; ins; inductive; two solder lug term	Standby Heater	JAN RW52J122	
R-120		RESISTOR, fixed: same as R-119	Standby Heater		
S-101	4257-8363K4 R17-S-28225	SWITCH, toggle: DPDT; JAN-ST22N; 3 amp 125 V; bakelite body; 1 1/32" lg x 23/32" wd x 23/32" h; bat handle 11/16" lg; locking action, normally closed; solder lug term; mtg bushing 15/32" lg x 15/32"-32 thd diam; JAN spec JAN-S-23	Power on-off Switch	AH&H 82305-B	
T-101	3300-296937717 R16-T-6499 2Z9619-219	TRANSFORMER, power: plate and filament type; input 115 V, 50-1600 cyc, single phase; 7 output windings secd #1, 2 and 3, 6.3 V at .65 A; secd #4 and 7, 5 V at 2 A; secd #5, 285 V AC, CT at 75 ma; secd #6, 405 V AC, CT at 125 ma; HS metal case; 4 3/8" lg x 4 3/8" wd x 5 1/2" h; 18 solder lug term on bottom; four 1/2-20 NC-2 thd mtg stud, 3 7/16" x 2 7/8" mtg/c	Furnishes all filament and B voltages	Lavoie Lab C-1367048	Lavoie Lab Dwg C-1367048
V-101	3300-234390000 16-T-55735 2J5Y3GT	TUBE, electron: rectifier	Rectifier for —200V supply	JAN 5Y3GT	JAN-1A
V-102	3300-234355000 16-T-55444 2J5R4GY	TUBE, electron: rectifier	Rectifier for +400 volt	JAN 5R4GY	JAN-1A
V-103	3300-234560000 16-T-56360 2J6J6	TUBE, electron: miniature dual triode w/single cathode	Video amplifier for external sine modulation	JAN 6J6	JAN-1A
V-104	3300-234445000 16-T-56177 2J6AG7	TUBE, electron: pentode	Dropping tube in +100 to +240 V voltage regulator	JAN 6AG7	JAN-1A
V-105	3300-234450000 16-T-56191 2J6AK5	TUBE, electron: miniature pent	Control tube in +100 to +240 V voltage regulator	JAN 6AK5	JAN-1A
V-106	3300-234006000 16-T-52001-05 2J0B2	TUBE, electron: miniature voltage regulator	Regulates voltage on V-105 and DC supply voltage for monitor bridge	JAN 0B2	JAN-1A
V-107		TUBE, electron: same as V-106	Regulates DC voltage of V-302A and V-305		
X-101	3300-295956842 R16-S-4670 2Z8678.195	SOCKET, tube: octal base; ceramic body; steel saddle, tinned; 1 25/32" x 1 1/4" x 11/16"; two 1/8" mtg holes 1 1/2" apart	Socket for V-101	Ucinite 115001/1A	
X-102		SOCKET, tube: same as X-101	Socket for V-102		
X-103	8850-885596 R16-S-6183-27	SOCKET, tube: miniature 7 prong; ceramic, 1 3/16" x 1 1/16" x 3/4"; two 1/8" mtg holes 7/8" apart o/a	Socket for V-103	JAN S010C	JAN-S-28
X-104		SOCKET, tube: same as X-101	Socket for V-104		
X-105		SOCKET, tube: same as X-103	Socket for V-105		

TABLE 6-1.—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
X-106		SOCKET, tube: same as X-103	Socket for V-106		
X-107		SOCKET, tube: same as X-103	Socket for V-107		
		RF OSCILLATOR CIRCUIT			
A-201	3300-291703118 R16-H-8267 2Z5091-54	HOUSING: Cavity End Housing; P/O Army-Navy Signal Generator TS-418/U; Housing Lavoie Lab part/dwg #1367429; 5 1/8" lg x 2 5/8" diam; eight 5/32" diam mtg holes 45° apart	Cavity and housing	Lavoie Lab Part #B-1367429	Lavoie Lab #B-1367429
A-202		RAIL, guide: cavity carriage guide; P/O Army-Navy Signal Generator TS-418/U; 5.53125" lg x .187" diam; mts by 6-32 thd .375" lg at end	Cavity carriage guide	Lavoie Lab Part #A-1367247	Lavoie Lab #A-1367247
A-203	3300-286236262 R16-B-6330 2Z736-47	BLOCK, support: Cavity support block; P/O Army-Navy Signal Generator TS-418/U; brass, rhodium pl; 2 7/8" lg x 2 3/4" wd x 3/4" thk	Cavity support block	Lavoie Lab Part #B-1367269	Lavoie Lab #B-1367269
A-204		COVER: p/o Army-Navy Signal Generator TS-418A/U; cad pl brass, gray enamel; 1 49/64" lg x 1 21/32" wd x 5/8" h o/a; eight 0.120" diam mtg holes, located two on ea side 29/32" c to c	Cover for twin filter part of cavity shield	Lavoie Lab Part #B-1367077	Lavoie Lab #B-1367077
A-205		COVER: p/o Army-Navy Signal Generator TS-418A/U; cad pl brass, gray enamel; 13 11/32" lg x 2 31/32" wd x 1/32" thk o/a; seventeen 0.063" diam mtg holes irregularly spaced	Top cover for cavity shield	Lavoie Lab Part #B-1367078	Lavoie Lab #B-1367078
A-206		HOUSING: p/o Army-Navy Signal Generator TS-418A/U; cad pl brass, gray enamel; irregularly shaped; 15 3/8" lg x 6 1/2" wd x 3" thk; twenty-three 0.120" diam mtg holes irregularly spaced	Part of cavity shield	Lavoie Lab Part #D-1367075	Lavoie Lab #D-1367075
A-207		HOUSING: p/o Army-Navy Signal Generator TS-418A/U; cad pl brass, exposed surfaces gray enamel; irregularly shaped; 13 11/32" lg x 6 1/2" wd x 2 31/32" thk; fifteen 0.063" diam mtg holes irregularly spaced	Part of cavity shield	Lavoie Lab Part #D-1367092	Lavoie Lab #D-1367092
E-201	3300-292241249 R16-K-3344-250 2Z5822-88	KNOB: fluted; black phenolic; for 1/4" diam shaft; two #10-32 Allen head cup pt set screw 90° apart; 1 5/8" diam x 3/4" h o/a; brass insert; shaft hole 1/2" d	Adjusts attenuation of RF signal output	Kurz-Kasch S-309-64-B-BB	
E-202	3300-292241452 R16-K-3374-30-400 2Z5822-280	KNOB: round; black anodized aluminum; for 1/4" diam shaft; two #6-32 set screws at 90° angle; 1 5/8" diam x 1 7/32" thk o/a; shaft hole 3/8" d; w/3/4" lg spinner handle located on 5/8" rad	Adjusts freq of RF output signal	Lavoie Lab A-1367017	Lavoie Lab Dwg A-1367017
E-203		CAVITY, tuned: 400 to 1000 mc; 1 mw into 50 ohms; resistive; 15 3/4" lg x 8 3/8" h x 5 1/4" deep o/a; 1/4 wave resonant line; receives power from electronic voltage regulator in power circuit; mts to front panel by six (6) irregularly located spacers ea w/#10-32 int thd; p/o Signal Generator TS-418/U	Provides a 400 - 1000 mc signal at a max power of 1 mw	Lavoie Lab D-1367200-C Sheet 1	Lavoie Lab Dwg E-1367553 D-1367200-C Sheet 1
E-203A	3300-326826155 R16-P-6309 3F3703	PROBE, RF: power absorbing assem for RF power monitoring of V-201; p/o Signal Generator TS-418/U; c/o hex brass rhodium pl tube w/brass body, cont fingers and pickup loop on inner end and RF cable RG-55/U terminating in UG-291/U extending 9" from outer end, hex tube has gear rack on one side and V-guide on opposite side; 13 3/8" lg x 9/16" diam; mts in 1/2" diam hole in attenuator block and held in place by engagement between rack and pinion	Carries RF output from oscillator to J-201	Lavoie Lab Part #B-1367201	Lavoie Lab #B-1367201

E-203B	3300-498645600 R16-P-6310 4Z9952	PROBE, RF: RF pick-up; p/o Signal Generator TS-418/U; cylindrical brass, rhodium pl case w/components mtd inside; power sensitivity range from 0.5 mw to 20 mw for resistance change from 1600 ohms to 54 ohms; cylindrical shape; 3¼" lg x ½" diam; mts in ½" diam hole in attenuator block, held in place by set screw	Monitors RF power output	Lavoie Lab Part #B-1367275	Lavoie Lab #B-1367275
E-203C	R17-1-6950-500	INSULATOR, plate: rectangular; mica; 1.250" lg; .875" wd, .010" thk; 4.116" diam mtg holes on 1.000" x .625" mtg/c p/o Army-Navy Signal Generator TS-418/U	Insulates thermistor from mtg block	Lavoie Lab Part #A-1367470	Lavoie Lab #A-1367470
E-203D	3300-331265848 R17-T-3670-525 3G350-44	INSULATOR, standoff: round post shape; phenolic w/steel stud in one end, term in other end; 1 1/16" lg; .203" diam; mts by #4-40 stud; stud rhodium pl; p/o Army-Navy Signal Generator TS-418/U	Term for lead of Resistor R-349	Lavoie Lab Part #B-1367441	Lavoie Lab #B-1367441
E-203E		INSULATOR, standoff: Same as E-203D	Term for lead of Resistor R-355		
E-203F	3300-286382800 R16-B-10671 2Z1239.215	BRACKET: filter support; "L" shape, brass, rhodium pl; 1.437" lg x 1.000" wd x 1.000" d; two .147" diam mtg holes on .500" mtg/c; p/o Army-Navy Signal Generator TS-418/U	Filter support	Lavoie Lab Part #A-1367460	Lavoie Lab #A-1367460
E-203G	3300-331212088 R16-I-5187 3G280-8	INSULATOR, disc: round; textolite; .250" h; 1.875" OD w/four .094" diam mtg holes 90 deg apart; p/o Army-Navy Signal Generator TS-418/U	Insulator for V-201	Lavoie Lab Part #A-1367265	Lavoie Lab #A-1367265
E-203H	R17-I-6950-800	INSULATOR, disc: round; mica; 1 15/16" diam x .010" thk, four .094" diam mtg holes 90 deg apart; p/o Army-Navy Signal Generator TS-418/U	Insulator for O-206	Lavoie Lab Part #A-1367263	Lavoie Lab #A-1367263
E-203J	3300-287387737 R16-B-11954 2Z3191-170	BRUSH, electrical cont tube grid cont; brass rhodium pl; cylindrical .870" diam x .563" lg; four .070" diam mtg holes on OD 90° apart; straight cont end; p/o Signal Generator TS-418/U	Grid contact	Lavoie Lab Part #A-1367238	Lavoie Lab #A-1367238
E-203K	3300-291703119 2Z5091-55	CYLINDER, grid: p/o Army-Navy Signal Generator TS-418/U; c/o cylinder, grid Lavoie Lab Part/Dwg #A-1367235, mt grid cylinder, Lavoie Lab Part/Dwg #B-1367166; brass, rhodium pl; 8.407" lg x 2.625" diam o/a; eight .1562" diam mtg holes, 45 deg apart on flange	Grid cylinder body	Lavoie Lab Part #B-1367165	Lavoie Lab #B-1367165
*E-203	3300-328557998 R16-C-16300-500 3F47800-18.2	CAVITY, tuned: 400 to 1000 mc; 1 mw into 50 ohms resistive; manual tuning; approx 16" lg x 8¾" h x 5¾" d o/a; has RF shield; ¼ wave resonant line; receives power from electronic voltage regulator in power circuit; mounts to front panel by six (6) irregularly located spacers each with #10-32 internal thread; p/o Signal Generator TS-418A/U	Provides a 400 - 1000 mc signal at a max power of 1 mw	Lavoie Lab Part D-1367200-C Sheet 3	Lavoie Lab D-1367200-C Sheet 3
H-201	6600-324382 R33-G-1712	GROMMET: black rubber; 1 1/16" OD x ½" ID x 5/16" thk; 1/16" groove	Protects Z-202 from vibration and shock	Atlan India Rub 2283	
H-202A	3300-656221501 R16-S-9829 6L31104-2	STUD: brass, rhodium pl; .406" lg; one end w/#4-40 thd, .156" lg; p/o Army-Navy Signal Generator TS-418/U	Tube retainer stud	Lavoie Lab Part #A-1367267	Lavoie Lab #A-1367267
H-202B		WASHER, lock: phosphor bronze rhodium pl; round OD .250", hole diam, .133" x .016" thk; shakeproof; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Lavoie Lab Part #A-1367438	Lavoie Lab #A-1367438
H-202C		STUD: same as H-202A	Same as H-202A		

TABLE 6-1.—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
H-203A		SCREW, machine: slot drive; bind H; brass, rhodium pl; #4-40; ¼" lg; ¼" thd; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Lavoie Lab Part #A-1367439-1	Lavoie Lab #A-1367439-1
H-203B		WASHER, lock: phosphor bronze rhodium pl; round .120" ID, .260" OD x .016" thk; shakeproof type, int teeth; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Lavoie Lab Part #A-1367440	Lavoie Lab #A-1367440
H-203C		SCREW, machine: same as H-203A	Same as H-203A		
H-203D		WASHER, lock: same as H-203B	Same as H-203B		
H-203E		SCREW, machine: same as H-203A	Same as H-203A		
H-203F		WASHER, lock: same as H-203B	Same as H-203B		
H-203G		SCREW, machine: same as H-203A	Same as H-203A		
H-203H		WASHER, lock: same as H-203B	Same as H-203B		
H-204A		SCREW, machine: same as H-203A	Same as H-203A		
H-204B		WASHER, lock: same as H-203B	Same as H-203B		
H-204C		SCREW, machine: same as H-203A	Same as H-203A		
H-204D		WASHER, lock: same as H-203B	Same as H-203B		
H-205A		SCREW, machine: slot drive; bind H; brass, rhodium pl; #4-40; 3/16" lg; 3/16" lg thd; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Lavoie Lab Part #A-1367439-2	Lavoie Lab #A-1367439-2
H-205B		WASHER, lock: same as H-203B	Same as H-203B		
H-205C		SCREW, machine: same as H-205A	Same as H-205A		
H-205D		WASHER, lock: same as H-203B	Same as H-203B		
H-205E		SCREW, machine: same as H-205A	Same as H-205A		
H-205F		WASHER, lock: same as H-203B	Same as H-203B		
H-205G		SCREW, machine: same as H-205A	Same as H-205A		
H-205H		WASHER, lock: same as H-203B	Same as H-203B		
H-206A		SCREW, machine: same as H-205A	Same as H-205A		
H-206B		WASHER, lock: same as H-203B	Same as H-203B		
H-206C		SCREW, machine: same as H-205A	Same as H-205A		
H-206D		WASHER, lock: same as H-203B	Same as H-203B		
H-206E		SCREW, machine: same as H-205A	Same as H-205A		
H-206F		WASHER, lock: same as H-203B	Same as H-203B		
H-206G		SCREW, machine: same as H-205A	Same as H-205A		
H-206H		WASHER, lock: same as H-203B	Same as H-203B		

H-207A		SCREW, machine: same as H-205A	Same as H-205A		
H-207B		WASHER, lock: same as H-203B	Same as H-203B		
H-207C		SCREW, machine: same as H-205A	Same as H-205A		
H-207D		WASHER, lock: same as H-203B	Same as H-203B		
H-207E		SCREW, machine: same as H-205A	Same as H-205A		
H-207F		WASHER, lock: same as H-203B	Same as H-203B		
H-207G		SCREW, machine: same as H-205A	Same as H-205A		
H-207H		WASHER, lock: same as H-203B	Same as H-203B		
H-208		SCREW, machine: slot drive; Fil H; brass, rhodium pl; #10-32; 1½" lg; 1½" thd; p/o Army-Navy Signal Generator TS-418/U	Feedback adjustment screw	Lavoie Lab Part #A-1367442	Lavoie Lab #A-1367442
H-209		NUT: hex; brass, rhodium pl; #10-32 thd; 3/16" thk; p/o Army-Navy Signal Generator TS-418/U	Nut for H-208	Lavoie Lab Part #A-1367443	Lavoie Lab #A-1367443
H-210A		SCREW, machine: slot drive; bind H; brass, rhodium pl; #6-32; 3/16" lg; 3/16" lg thd; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Lavoie Lab Part #A-1367437-1	Lavoie Lab #A-1367437-1
H-210B		WASHER, lock: phosphor bronze rhodium pl; round .146" ID, .280" OD x .018" thk; shakeproof type, int teeth, p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Lavoie Lab Part #A-1367436	Lavoie Lab #A-1367436
H-210C		SCREW, machine: same as H-210A	Same as H-210A		
H-210D		WASHER, lock: same as H-210B	Same as H-210B		
H-211A		SCREW, machine: same as H-210A	Same as H-210A		
H-211B		WASHER, lock: same as H-210B	Same as H-210B		
H-211C		SCREW, machine: same as H-210A	Same as H-210A		
H-211D		WASHER, lock: same as H-210B	Same as H-210B		
H-212A		SCREW, machine: same as H-210A	Same as H-210A		
H-212B		WASHER, lock: same as H-210B	Same as H-210B		
H-213	R16-S-2189-502	SCREW, adjustment: brass, rhodium pl; adjusts alignment of attenuator; p/o Army-Navy Signal Generator TS-418/U	Adjusts alignment of attenuator	Lavoie Lab Part #A-1367467	Lavoie Lab #A-1367467
H-214A		SCREW, machine: slot drive; RH; brass rhodium pl; #2-56; ½" lg; ½" lg thd; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Lavoie Lab Part #A-1367435-1	Lavoie Lab #A-1367435-1
H-214B		SCREW, machine: same as H-214A	Same as H-214A		
H-214C		SCREW, machine: same as H-214A	Same as H-214A		
H-214D		SCREW, machine: same as H-214A	Same as H-214A		
H-215A		SCREW, machine: slot drive; bind H; brass rhodium pl; #2-56 thd; 1/8" lg; 1/8" lg thd; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Lavoie Lab Part #A-1367434	Lavoie Lab #A-1367434
H-215B		WASHER, lock: phosphor bronze rhodium pl; round .092" ID .180" OD x .012" thk; shakeproof type, int tooth; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Lavoie Lab Part #A-1367433	Lavoie Lab #A-1367433

TABLE 6-1.—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
H-215C		SCREW, machine: same as H-215A	Same as H-215A		
H-215D		WASHER, lock: same as H-215B	Same as H-215B		
H-216A		SCREW, machine: slot drive; bind H; brass rhodium pl; #6-32; ½" lg; ½" thd; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Lavoie Lab Part #A-1367437-2	Lavoie Lab #A-1367437-2
H-216B		WASHER, lock: same H-210B	Same as H-210B		
H-216C		SCREW, machine: same as H-216A	Same as H-216A		
H-216D		WASHER, lock: same H-210B	Same as H-210B		
H-217A		SCREW, machine: slot drive; bind H; brass rhodium pl; #10-32; ⅜" lg; ⅜" lg thd; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Lavoie Lab Part #A-1367432	Lavoie Lab #A-1367432
H-217B		WASHER, lock: phosphor bronze rhodium pl; round .200" ID, .376" OD x .22" thk; shakeproof type, int tooth; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Lavoie Lab Part #A-1367431	Lavoie Lab #A-1367431
H-218A		SCREW, machine: slot drive; bind H; brass rhodium pl; #6-32; ⅜" lg; ⅜" lg thd; p/o Army-Navy Generator TS-418/U	Cavity hardware	Lavoie Lab Part #A-1367437-3	Lavoie Lab #A-1367437-3
H-218B		WASHER, lock: same as H-210B	Same as H-210B		
H-219A		SCREW, machine: slot drive; RH; brass, rhodium pl; #6-32; 5/16" lg; 5/16" lg thd; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Lavoie Lab Part #A-1367430-1	Lavoie Lab #A-1367430-1
H-219B		WASHER, lock: same as H-210B	Same as H-210B		
H-219C		SCREW, machine: same as H-219A	Same as H-219A		
H-219D		WASHER, lock: same as H-210B	Same as H-210B		
H-219E		SCREW, machine: same as H-219A	Same as H-219A		
H-219F		WASHER, lock: same as H-210B	Same as H-210B		
H-219G		SCREW, machine: same as H-219A	Same as H-219A		
H-219H		WASHER, lock: same as H-210B	Same as H-210B		
H-219I		SCREW, machine: same as H-219A	Same as H-219A		
H-219J		WASHER, lock: same as H-210B	Same as H-210B		
H-219K		SCREW, machine: same as H-219A	Same as H-219A		
H-219L		WASHER, lock: same as H-210B	Same as H-210B		
H-219M		SCREW, machine: same as H-219A	Same as H-219A		
H-219N		WASHER, lock: same as H-210B	Same as H-210B		
H-220A		SCREW, machine: same as H-219A	Same as H-219A		
H-220B		WASHER, lock: same as H-210B	Same as H-210B		

H-220C		SCREW, machine: same as H-219A	Same as H-219A		
H-220D		WASHER, lock: same as H-210B	Same as H-210B		
H-220E		SCREW, machine: same as H-219A	Same as H-219A		
H-220F		WASHER, lock: same as H-210B	Same as H-210B		
H-220G		SCREW, machine: same as H-219A	Same as H-219A		
H-220H		WASHER, lock: same as H-210B	Same as H-210B		
H-220I		SCREW, machine: same as H-219A	Same as H-219A		
H-220J		WASHER, lock: same as H-210B	Same as H-210B		
H-220K		SCREW, machine: same as H-219A	Same as H-219A		
H-220L		WASHER, lock: same as H-210B	Same as H-210B		
H-220M		SCREW, machine: same as H-219A	Same as H-219A		
H-220N		WASHER, lock: same as H-210B	Same as H-210B		
H-221A		SCREW, machine: same as H-219A	Same as H-219A		
H-221B		WASHER, lock: same as H-210B	Same as H-210B		
H-222A		SCREW, machine: same as H-219A	Same as H-219A		
H-222B		WASHER, lock: same as H-210B	Same as H-210B		
H-223A		SCREW, machine: slot drive; RH; brass rhodium pl; #6-32; 3/16" lg; 3/16" lg thd; p/o Signal Generator TS-418/U	Cavity hardware	Lavoie Lab Part #A-1367430-2	Lavoie Lab #A-1367430-2
H-223B		WASHER, lock: same as H-210B	Same as H-210B		
H-224A		SCREW, machine: same as H-223A	Same as H-223A		
H-224B		WASHER, lock: same as H-210B	Same as H-210B		
H-225A		SCREW, machine: slot drive; RH; brass rhodium pl; #2-56; 1/8" lg; 1/8" lg thd; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Lavoie Lab Part #A-1367435-2	Lavoie Lab #A-1367435-2
H-225B		SCREW, machine: same as H-225A	Same as H-225A		
H-225C		SCREW, machine: same as H-225A	Same as H-225A		
H-225D		SCREW, machine: same as H-225A	Same as H-225A		
H-226	3300-696896877 R16-G-5225-500 6Z4920-37	GROMMET: phenolic; fits .1875" diam hole; .0935" diam hole, .055" groove wd, .125" wd x .250" diam o/a; p/o Army-Navy Signal Generator TS-418/U	Provides mtg for R-203	Lavoie Lab Part #A-1367237	Lavoie Lab #A-1367237
H-227A		SCREW, machine: slot drive; bind H; brass rhodium pl; #2-56; 7/16" lg; 7/16" lg thd; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Lavoie Lab Part #A-1367435-3	Lavoie Lab #A-1367435-3
H-227B		WASHER, lock: same as H-215B	Same as H-215B		
H-227C		SCREW, machine: same as H-227A	Same as H-227A		
H-227D		WASHER, lock: same as H-215B	Same as H-215B		
H-227E		SCREW, machine: same as H-227A	Same as H-227A		
H-227F		WASHER, lock: same as H-215B	Same as H-215B		

TABLE 6-1.—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
H-228		WASHER, flat: brass, rhodium pl; round .265" ID, ½" OD x .018" thk; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Lavoie Lab Part #A-1367420	Lavoie Lab #A-1367420
H-229		SCREW, machine: slot drive; RH; brass, rhodium pl; #6-32; ½" lg; ½" lg thd; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Lavoie Lab Part #A-1367430-3	Lavoie Lab #A-1367430-3
H-230		SCREW, machine: same as H-229	Same as H-229		
H-231		SCREW, machine: same as H-229	Same as H-229		
H-232		SCREW, machine: slot drive; fil hd; brass; rhodium pl; #10-32; 1⅛" lg; 1⅛" lg thd; p/o Army-Navy Signal Generator TS-418A/U	Frequency control screw	Lavoie Lab Part #A-1367442-2	Lavoie Lab #A-1367442-2
I-201	3300-291396125 2Z3723-73	DIAL: vernier; p/o Army-Navy Signal Generator TS-418/U; dial, aluminum, black enamel clear lacquer finish, hub cad pl iridited; 100 calibration lines equally spaced through 360 deg; 2¾" diam x ⅜" thk o/a; mts to .250" diam shaft w/two #6-22 set screws	Vernier	Lavoie Lab Part #A-1367418	Lavoie Lab #A-1367418
I-202	3300-291396127 2Z3723-75	DIAL: attenuator indicating dial; p/o Army-Navy Signal Generator TS-418/U; dial aluminum black enamel clear lacquer finish hub cad pl iridited; outer scale 0 to 120 clockwise on 325 deg arc, inner scale .2 to 200K counter-clockwise on 324.9 deg arc; 4" diam x ⅜" thk o/a; mts to .250" diam shaft w/two #6-32 set screws	Attenuator indicating dial	Lavoie Lab Part #B-1367417	Lavoie Lab #B-1367417
I-203	3300-291396127 R16-D-2445-450 2Z3723-75	DIAL: frequency indicating dial; c/o dial, Lavoie Lab Part/dwg #C-1367450, shaft, Lavoie Lab Part/dwg #A-1367494, hub, Lavoie Lab Part/dwg #A-1367497; outer scale calibrated 400 to 1000 on 325 deg arc, inner scale calibrated 0 to 23 on 345 deg arc; 4" diam x 1 1/16" lg	Frequency indicating dial	Lavoie Lab Part #B-1367424	Lavoie Lab #B-1367424
J-201	8850-654440 R16-R-2435-1 2Z3062-167	CONNECTOR, receptacle: Army-Navy UG-291/U; single round female cont; straight type; 1⅛" lg x ⅜" diam; cylindrical brass body, silver pl; polystyrene insert; 7/16" diam cable opening; 1 1/16" x 1 1/16" mtg base; four .356" tapped mtg holes on ½" mtg centers	RF output jack	JAN UG-291/U	Navy Dwg RE49F246D
L-212	3300-308413504 R16-S-10060-250 3C1084G1-4	SUPPRESSOR, parasitic: resistor and coil; 3⅜" lg x 7/16" diam; inductance .23 uh; 12 turns #30 wire, 470K ohms ½ W resistor; two axial wire leads; p/o Army-Navy Signal Generator TS-418/U	Prevents entrance of RF signal to DC source for oscillator grid	Lavoie Lab Part #A-1367453	Lavoie Lab #A-1367453
O-201	3300-286675200 R16-C-4421 2Z1607-85	CAP: Cavity end cap; p/o Army-Navy Signal Generator TS-418/U; brass, rhodium pl; 2.250" diam x .500" thk; mts to cavity by 2⅛"-32 thd; OD of cap knurled	Cavity end cap	Lavoie Lab Part #A-1367287	Lavoie Lab #A-1367287
O-202	3300-291614135 R16-G-2334-55 2Z4867.611	GASKET: Cavity cap gasket; compressed monel metal; one hole; 2.078" diam x ⅛" thk; p/o Army-Navy Signal Generator TS-418/U	Cavity cap gasket	Lavoie Lab Part #A-1367444	Lavoie Lab #A-1367444

O-203	3300-295533337 R16-R-21197-835 2Z7780-82	RETAINER, tube: p/o Army-Navy Signal Generator TS-418/U; holds JAN-2C40 tube in cavity; and makes plate cont; brass, rhodium pl; 1.125" diam x .500" thk; mts by 1⅛"-32 thd	Holds JAN-2C40 tube in cavity and also makes plate contact	Lavoie Lab Part #A-1367266	Lavoie Lab #A-1367266
O-204A	3300-286410901 R16-B-14905-500 2Z1409-148	BUSHING: ins thermistor from mtg screws; phenolic; male; .105" lg, .185" OD, .116" ID, shoulder ¼" diam; p/o Army-Navy Signal Generator TS-418/U	Insulates thermistor from mtg screw	Lavoie Lab Part #A-1367456	Lavoie Lab #A-1367456
O-204B		BUSHING: same as O-204A			
O-204C		BUSHING: same as O-204A			
O-204D		BUSHING: same as O-204A			
O-205	3300-291643460 R16-G-7040 2Z4885-166	GUIDE, shaft: guides attenuator into cavity; p/o Army-Navy Signal Generator TS-418/U; c/o mtg plate Lavoie Lab Part/dwg #A-1367414, insert Lavoie Lab part/dwg #A-1367413 and adjusting screw Lavoie Lab part/dwg #A-1367467; $1\frac{19}{32}$" lg x 1" wd x $\frac{19}{32}$" thk o/a; mts by two $\frac{5}{32}$" diam holes on .688" mtg ctr	Attenuator guide	Lavoie Lab Part #A-1367454	Lavoie Lab #A-1367454
O-206	3300-295533336 R16-R-21197-814 2Z7780-81	RETAINER, tube: provides mtg for JAN-2C36 and forms plate cont; p/o Army-Navy Signal Generator TS-418/U; brass, rhodium pl; 1.875" diam x .250" thk; four .156" diam mtg holes 90 deg apart	Provides mtg for V-201 and forms plate contact	Lavoie Lab Part #A-1367264	Lavoie Lab #A-1367264
O-207	3300-296470019 R16-S-8450-61 2Z8877.245	SPRING: flat type; dial stop spring; beryllium copper, rhodium pl; 2.031" lg x .250" wd x .018" thk; five mtg holes, two .157" diam, two .098" diam, one .052" diam irregularly spaced; p/o Army-Navy Signal Generator TS-418/U	Spring for O-208	Lavoie Lab Part #A-1367289	Lavoie Lab #A-1367289
O-208	3300-328551025 R16-A-5163 3F31300	ARM: dial stop arm follower; p/o Army-Navy Signal Generator TS-418/U; brass, rhodium pl; 1.188" lg. x .250" wd x .297" thk; two #2-56 tapped mtg holes on .750" mtg ctr	Cam follower for dial stop	Lavoie Lab Part #A-1367290	Lavoie Lab #A-1367290
O-209	3300-291632292 R16-G-2707-1 2Z4878-644	GEAR: rack gear; brass, rhodium pl; cavity drive rack; straight teeth; 56 teeth; 48 pitch; $5\frac{9}{32}$" lg x 7/16" wd x ⅛" thk o/a; str face; one $\frac{5}{32}$" diam mtg hole one end; p/o Army-Navy Signal Generator TS-418/U	Cavity drive rack	Lavoie Lab Part #B-1367293	Lavoie Lab #B-1367293
O-210	3300-286236261 R16-B-6335 2Z736-46	BLOCK, guide: carriage drive guide; p/o Army-Navy Signal Generator TS-418/U; c/o carriage drive block Lavoie Lab Part/dwg #A-1367251, bushing Lavoie Lab Part/dwg #A-1367249, insert Lavoie Lab Part/dwg #A-1367250; brass, rhodium pl; $1\frac{1}{16}$" lg x 1⅛" wd x $1\frac{3}{16}$" h; 5 irregularly spaced mtg holes, ctr hole #6-32 tap, other holes #4-40 tap	Carriage drive guide block	Lavoie Lab Part #A-1367248	Lavoie Lab #A-1367248
O-211		SHAFT: cavity carriage drive shaft; p/o Army-Navy Signal Generator TS-418/U; ss; 5.53125" lg x .249" diam; mts w/10-32 thd .125" lg at end	Cavity carriage drive shaft	Lavoie Lab Part #A-1367246	Lavoie Lab #A-1367246
O-212	3300-673653701 R16-G-7047 6Q48540-1	GUIDE, support: guides and supports cavity carriage p/o Army-Navy Signal Generator TS-418/U; brass rhodium pl; $7\frac{13}{16}$" lg x 1⅞" diam; eleven holes irregularly spaced on plate	Guides and supports cavity carriage	Lavoie Lab Part #A-1367427	Lavoie Lab #A-1367427
O-213	3300-328553310 R16-B-11953 3F33400	BRUSH, electrical contact: cavity grid cont; brass, rhodium pl; cylindrical shape w/two guide rods on one end, 6¼" lg x 1" diam o/a; mts by one slot in end of each rod, slot $\frac{9}{32}$" lg x ⅛" wd; concave cont; p/o Army-Navy Signal Generator TS-418/U	Cavity grid contact fingers	Lavoie Lab Part #B-1367226	Lavoie Lab #B-1367226

TABLE 6-1.—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
O-214	3300-328553311 R16-B-11952 3F33400-1	BRUSH, electrical contact: cavity plate cont; brass, rhodium pl; cylindrical shape w/two guide rods on one end, $8\frac{7}{16}$" lg x 2" diam o/a; mts by one slot in end of each rod, slot $\frac{9}{32}$" lg x $\frac{1}{8}$" wd; concave cont; p/o Army-Navy Signal Generator TS-418/U	Cavity plate contact	Lavoie Lab Part #B-1367219	Lavoie Lab #B-1367219
O-215	3300-286059309 R16-C-4200-501 2Z380-77	CAM: dial stop; p/o Army-Navy Signal Generator TS-418/U; brass, rhodium pl; 1.313" lg x .438" wd x .250" thk; mtg to dial shaft w/6-32 RH screw	Dial stop	Lavoie Lab Part #A-1367493	Lavoie Lab #A-1367493
O-216		CAM: same as O-215	Same as O-215		
O-217	3300-291632291 R16-S-3851-5 2Z4878-663	SHAFT: vernier dial drive gear and shaft; p/o Army-Navy Signal Generator TS-418/U; c/o gear Lavoie Lab part/dwg #A-1367488, shaft Lavoie Lab part/dwg #A-1367486, shaft Lavoie Lab part/dwg #A-1367489; brass gear cadmium pl, shaft ss; $2\frac{13}{32}$" lg x $\frac{35}{64}$" diam o/a	Vernier dial drive	Lavoie Lab Part #A-1367423	Lavoie Lab #A-1367423
O-218	3300-291632294 R16-G-2706-6 2Z4878-666	GEAR: spur type; brass, cad pl and iridite; dial drive straight teeth; 36 teeth; 48 pitch, .750" pitch diam; OD .7916", ID .187", $\frac{1}{8}$" thk; straight face; p/o Army-Navy Signal Generator TS-418/U	Dial drive gear	Lavoie Lab Part #A-1367485	Lavoie Lab #A-1367485
O-219	3300-291632293 R16-G-2715 2Z4878-665	GEAR: spur type; cadmium pl brass iridite; dial drive gear, straight teeth; 144 teeth; 48 pitch, 3.000" pitch diam; $3\frac{1}{16}$" OD, .250" hole diam, gear .093" thk; hub extends .424" from one face; straight face; hub 1" diam mts to $\frac{1}{8}$" shaft, locked by two #6-32 set screws 90 deg apart; p/o Army-Navy Signal Generator TS-418/U	Dial drive gear	Lavoie Lab Part #B-1367422	Lavoie Lab #B-1367422
O-220	3300-291632295 R16-S-3851-15 2Z4878-667	SHAFT: cavity drive pinion gear and shaft; p/o Army-Navy Signal Generator TS-418/U; c/o gear Lavoie Lab part/dwg #A-1367283, shaft Lavoie Lab part/dwg #A-1367271; brass gear cad pl, ss, shaft; $2\frac{13}{32}$" lg x $\frac{27}{64}$" diam o/a	Cavity drive pinion gear	Lavoie Lab Part #A-1367421	Lavoie Lab #A-1367421
O-221	3300-296470020 R16-G-7043 2Z8877.246	SPRING: guide; flat type; carriage drive guide; beryllium copper rhodium pl; .796" lg x .500" wd x .015" thk; three .094" diam mtg holes two on one end on .313" mtg c, one on ctr line; p/o Army-Navy Signal Generator TS-418/U	Carriage drive guide	Lavoie Lab Part #A-1367273	Lavoie Lab #A-1367273
O-222	3300-293526385 R16-S-6310 2Z7093-188	PLATE, spacer: spacer in carriage drive; p/o Army-Navy Signal Generator TS-418/U; brass rhodium pl; .500" lg x .188" wd x .031" thk; two .094" mtg holes on .313" mtg ctr	Spacer in carriage drive	Lavoie Lab Part #A-1367272	Lavoie Lab #A-1367272
O-223	3300-286221538 R16-B-14905-400 2Z580-64	BEARING, sleeve: bearing for dial drive shaft, brass rhodium pl; female bushing; 1.482" lg x .437" diam w/.500" sq end, .417" diam x .188" lg undercut; p/o Army-Navy Signal Generator TS-418/U	Bearing for dial drive shaft	Lavoie Lab Part #A-1367270	Lavoie Lab #A-1367270
O-224	3300-286059310 R16-A-5162 2Z380-78	ARM: attenuator stop arm; p/o Army-Navy Signal Generator TS-418/U; hard drawn brass rhodium pl; no dim of this item is greater than one inch	Attenuator stop arm	Lavoie Lab Part #A-1367480	Lavoie Lab #A-1367480

O-225	3300-295559901 R16-S-3851-10 2Z8204-90	SHAFT: attenuator drive gear; p/o Signal Generator TS-418/U; c/o gear Lavoie Lab Dwg #1367419 and sleeve bearing Lavoie Lab Dwg #1367478; $3^{21}/_{32}$" lg x $^{23}/_{32}$" diam; mts by $^{3}/_{8}$-32" bushing	Attenuator drive gear	Lavoie Lab Part #A-1367419	Lavoie Lab #A-1367419
O-226	R16-S-3890-20	SHIELD, end: p/o RF oscillator shield which has cont to prevent leakage around attenuator; p/o Army-Navy Signal Generator TS-418A/U; c/o plate Lavoie Lab Dwg #1367100 and cont Lavoie Lab Dwg #1367101-1; $2^{19}/_{32}$" lg x $2^{15}/_{32}$" wd x $^{35}/_{64}$" h o/a; mts by eight 0.120" diam mtg holes irregularly spaced	Prevents RF leakage around attenuator	Lavoie Lab Part #B-1367079	Lavoie Lab #B-1367079
O-227		CAP: p/o Army-Navy Signal Generator TS-418A/U; cad pl brass, gray enamel; 2.865" diam x 0.250" thk; four 0.093" diam mtg holes located 90° apart on circum	End cover for cavity shield	Lavoie Lab Part #B-1367103	Lavoie Lab #B-1367103
O-228		CAP: p/o Army-Navy Signal Generator TS-418A/U; cad pl brass, gray enamel; 2.865" diam x 0.250" thk; three 0.120" diam mtg holes located 120° apart on rad	End cover for cavity shield	Lavoie Lab Part #B-1367076	Lavoie Lab #B-1367076
R-201	3300-381219680 R16-R-17263-59-3 3RC21BF471K	RESISTOR, fixed: comp; 470 ohms ±10%; ½ w; "F" characteristic; .655" lg x .249" diam; two axial wire leads	Element of filter for RF oscillator plate lead	JAN RC21BF471K	JAN-R-11
R-202	3300-396501601 R16-R-17257-107 3Z6005G7-1	RESISTOR, fixed: comp; 57 ohms ±3%; 0.5 w; "F" characteristic; .140" diam x .375" lg; two axial wire leads	Terminates generator end of RF transmission line--p/o RF Probe E-203A	Lavoie Lab Part #A-1367459	Lavoie Lab #A-1367459
R-203	3300-381168880 R16-R-17279-0-915 3RC20BF332J	RESISTOR, fixed: comp; 3300 ohms ±5%; ½ w; "F" characteristic; .468" lg x .249" diam; two axial wire leads	Part of grid leak for V-201 Couples RF oscillator grid to plate of V-306	JAN RC20BF332J	JAN-R-11
R-204	3300-399730001 R16-T-2268 3Z6926-12.9	RESISTOR, thermal: bead thermistor glass envelope, 33-47 ohms w/25 ma; $^{12}/_{32}$" lg x $^{1}/_{8}$" diam; glass ins; axial wire leads 1¾" lg	Provides change in bridge balance	WECo D166382	
R-205	R16-R-17258-21-400	RESISTOR, fixed: comp; 68 ohms ±10%; ½ w; "F" characteristic; .468" lg x .249" diam; two axial wire leads	Matching resistor of monitor pick-up loop	JAN RC20BF680K	JAN-R-11
V-201	3300-234190062 16-T-52336 2J2C36	TUBE, electron: Sylvania Prod 2C36; high freq triode	Functions as UHF oscillator	Sylvania Prod 2C36	
	R17-W-3208	WIRE, electrical: #38 AWG nichrome wire, single layer; glass braid ins, silicone impre, resistance 42.19 ohms/ft at 68° F; wire w/ins not to be greater than .0085"	Bulk quantity to fabricate W-202	Lavoie Lab Part #A-1367425	Lavoie Lab #A-1367425
W-202	3300-322866023 3E7998-8.4	WIRE, electrical: #38 AWG nichrome, wire single layer glass braid ins silicone impr. resistance 42.19 ohms/ft at 68°; 8½" lg w/½" on each end silver pl	Complete grid circuit from R-203 to L-212	Lavoie Lab Part #A-1367426	Lavoie Lab #A-1367426
W-203	3300-322866022 R16-L-8164-524 3E7998-8.3	LEAD, electrical: JAN type SRIR 1 (7) 20-C-1; 8" lg; term Lavoie Lab Part/dwg #A-1367242; one end, other end tinned; Lavoie Lab Part/dwg #A-1367428; p/o Army-Navy Signal Generator TS-418/U	Filament lead from V-201	Lavoie Lab Part #A-1367428	Lavoie Lab #A-1367428
Z-201	3300-387540001 R16-F-1954-805 3Z1892-4.2	FILTER, low pass: rejects all freq above 5 mc; $4^{11}/_{16}$" lg x ½" diam; cylindrical brass, rhodium pl case; mtgs by single #10-32 thd stud at one end and wire lead at other end; p/o Signal Generator TS-418/U	Prevents RF power from reaching plate supply	Lavoie Lab Part #B-1367448	Lavoie Lab #B-1367448

TABLE 6-1.—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
Z-202	3300-387540002 R16-F-1954-800 3Z1892-4.3	FILTER, low pass: rejects all freq above 5 mc; 3 1/16" lg x 1 1/8" diam; cylindrical, rhodium pl case; mts by single 3/8"-32 thd stud at one end; two wire leads at mtg end, two solder lug term at other end; p/o Signal Generator TS-418/U	Prevents RF power from reaching filament and grid supplies	Lavoie Lab Part #B-1367447	Lavoie Lab #B-1367447
††Z-203	R16-F-1950-975	FILTER, low pass: rejects all freq above 5 mc; 2 1/2" lg x 1/2" diam; cylindrical brass, rhodium plated case; mts by single #10-32 thd stud at one end; single wire lead at mtg end; p/o Army-Navy Signal General TS-418A/U	Prevents RF leakage from cavity	Lavoie Lab Part #B-1367196	Lavoie Lab #B-1367196
††Z-204		FILTER, low pass: same as Z-203	Same as Z-203		
Z-205	R16-F-1950-850	FILTER, low pass: rejects all freq above 5 mc; 5 1/2" lg x 1/2" diam; cylindrical brass, rhodium plated case; mts by single #10-32 thd stud at other end; single wire lead at ea end and solder lug term at other end; p/o Army-Navy Signal Generator TS-418A/U	Prevents RF leakage from cavity	Lavoie Lab Part #B-1367195	Lavoie Lab #B-1367195
††Z-206		FILTER, low pass: same as Z-203	Same as Z-203		
		PULSE GENERATING AND MODULATING CIRCUIT			
C-301		CAPACITOR, fixed: same as C-108	Couples external sync jack to sync selector switch		
C-302	3300-317760138 R16-C-11252-600 3DA100-913	CAPACITOR, fixed: paper; .1 mf ±10%; 600 vdcw; Hs metal case; 1 5/16" lg x 49/64" wd x 1 3/8" h; two solder lug term on bottom; two .156" mtg slots	Couples output of V-301A to sync selector switch	JAN CP65B1DF104K	JAN-C-25
C-303	3300-376037780 R16-C-10026-10-30 3K2051142	CAPACITOR, fixed: mica; 510 mmf ±5%; 500 vdcw; molded low loss bakelite case; 51/64" lg x 15/32" wd x 7/32" thk; two #20 axial wire leads	Couples positive sync T-301	JAN CM20D511J	JAN-C-5
C-304		CAPACITOR, fixed: same as C-302	Couples output plate of V-301B to grid of V-302A		
C-305		CAPACITOR, fixed: same as C-303	Couples output of V-301B to T-301		
C-306A C-306B	3300-317760140 R16-C-11333-100-25 3DA100-915	CAPACITOR, dual: paper; each secti .1 mf ±15%; 600 vdcw; oil filled and impr; 1 5/16" lg x 49/64" wd x 1 3/8" h; two solder lug term on bottom; two .156" mtg slots	Determines pulse freq on X1 range	JAN CP65B6DF104L	JAN-C-25
C-307	3300-376182460 R16-C-10465-56 3K4068252	CAPACITOR, fixed: mica; 6800 mmf ±5%; 500 vdcw; molded low loss bakelite case; 1 1/32" lg x 41/64" wd x 11/32" thk; two #18 axial wire leads	Determines pulse freq on X10 range	JAN CM40E682J	JAN-C-5
C-308	3300-313889986 R16-C-8345-1-100 3D9100-259	CAPACITOR, fixed: ceramic; 100 mmf ±10%; 500 vdcw; 1.328" lg x .340" diam; neg temp coef —150 (tol ±25) mmf/mf/°C; two axial wire leads	Couples output of V-302A to cathode V-302B	JAN CC36PK101K	JAN-C-20-A

C-309	3300-316958883 R16-C-11419-2-100 3DB1-261	CAPACITOR, fixed: paper; 1 mf ±10%; 600 vdcw; oil filled and impr 1 5/16" lg x 49/64" wd x 2½" h; two solder lug term on bottom; two .156" mtg slots	Filter element for —105V supply	JAN CP65B1DF105K	JAN-C-25
C-310	3300-376143250 R16-C-10077-2 3K3091143	CAPACITOR, fixed: mica; 910 mmf ±2%; 500 vdcw; molded low loss bakelite case; 53/64" lg x 53/64" x 9/32" thk; two #18 axial wire leads	Determines duration of Pulse delay	JAN CM30D911G	JAN-C-5
C-311	3300-313184085 R16-C-7867-34-60 3D9024-10	CAPACITOR, fixed: ceramic; 24 mmf ±5%; 500 vdcw; neg temp coef zero (tol +60) mmf/mf/°C; .812" lg x .250" diam; two axial wire leads	Differentiates and couples output plate of V-303B to grid V-306	JAN CC26CH240J	JAN-C-20A
C-312	3300-376036600 R16-C-9872-37 3K2051032	CAPACITOR, fixed: mica; JAN type CM20C510J; 51 mmf ±5%; 500 vdcw; molded low loss bakelite case; 51/64" lg x 15/32" wd x 7/32" thk; two #20 axial wire leads	Couples trigger to sync out circuit	JAN CM20C510J	JAN-C-25
C-313	3300-376002000 R16-C-9924-61 3K2010121	CAPACITOR, fixed: mica; JAN type #CM20B101K; 100 mmf ±10%; 500 vdcw; molded low loss bakelite case; 51/64" lg x 15/32" wd x 7/32" thk; two axial wire leads	Determines natural freq of blocking oscillator	JAN CM20B101K	JAN-C-25
C-314		CAPACITOR, fixed: same as C-108	Blocking capacitor		
C-315	3300-313889985 R16-C-8335-400 3D9100-258	CAPACITOR, fixed: ceramic; 100 mmf ±2%; 500 vdcw; neg temp coef zero (tol +60) mmf/mf/°C; .328" lg x .340" diam; two axial wire leads	Couples plate of V-305A to grid of V-306; determines pulse duration	JAN CC36CH101G	JAN-C-20A
C-316	3300-313584160 R16-C-8276-238 3D9051-11	CAPACITOR, fixed: ceramic; JAN CC36CH510G; 51 mmf ±2%; 500 vdcw; neg temp coef zero (tol +60) mmf/mf/°C; .328" lg x .340" diam; two axial wire leads	Couples grid of V-306 to grid of V-305A; determines pulse duration	JAN CC36CH510G	JAN-C-20A
C-317	3300-317680796 R16-C-11255-23-50 3DA10-367	CAPACITOR, fixed: paper; molded JAN CN35A103M; 10,000 mmf ±20%; 600 vdcw; oil filled and impr; black molded bakelite; 53/64" lg x 53/64" wd x 11/32" thk; two axial wire leads	Couples output plate V-305B to grid of V-306	JAN CN35A103M	JAN-C-91
C-318	3300-376018000 R16-C-9814-96 3K2024032	CAPACITOR, fixed: mica; JAN type #CM20C240J; 24 mmf ±5%; 500 vdcw; molded low loss bakelite case; 51/64" lg x 15/32" wd x 7/32" thk; two #20 axial wire leads	Couples trigger from modulator tube to inverter for delayed sync circuit	JAN CM20C240J	JAN-C-25
C-319		CAPACITOR, fixed: same as C-313	Same as C-313		
C-320	3300-312860530 R16-C-7855-250 3D9005-70	CAPACITOR, fixed: ceramic dielectric; JAN type #CC21CK-050C; 5 mmf ±0.25 mmf; 500 vdcw; neg temp coef zero (tol +250) mmf/mf/0°C; .562" lg x .250" diam; two axial wire leads	Suppresses spurious oscillation	JAN CC21CK050C	JAN-C-20A
C-321		CAPACITOR, fixed: same as C-318	Couples output of pulse rate blocking oscillator to inverter tube V-304A		
C-322		CAPACITOR, fixed: same as C-318	Widens sync out pulse		
C-323		CAPACITOR, fixed: same as C-318	Widens delayed sync out pulse		
C-324A C-324B		CAPACITOR, dual: same as C-306A & B	Part of RC filter		
C-341		CAPACITOR, fixed: same as C-312	Couples inverter tube output to delayed sync circuit		

TABLE 6-1.—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
E-301	3300-331265849 R16-T-3670-525 3G350-45	INSULATOR, stand off: post shape; phenolic w/steel stud in one end, term on other end; 1⅛" lg; .203" diam; mts by #4-40 thd stud; p/o Army-Navy Signal Generator TS-418/U	Term for lead of Capacitor C-301	Lavoie Lab Part #LA-404099-2	Lavoie Lab #LA-404099-2
E-302	Not used				
E-303	3300-387257871 3Z770-42.1	BOARD, terminal: resistor binding post strip; 42 solder lug term; brass, silver pl; eight pr at 1⅞" centers, thirteen pr at 1⅜" centers; molded phenolic xxx bakelite; 8⅞" lg x 2½" wd x ⅛" thk; five #31 (.120) drill mtg holes; four 8½" x 1½" mtg centers, one on centerline; 1/32" thk bakelite plate mtd on back	To support circuit components R-303, R-304, R-305, R-307, R-308, R-310, R-318, R-319, R-327, R-328, R-329, R-330, R-344, R-345, C-305, C-313, C-315, C-316, C-317	Lavoie Lab Part B-1367331	Lavoie Lab B-1367331
E-304	3300-387257863 3Z770-40.2	BOARD, terminal: resistor binding post strip; 40 solder lug term, brass, silver pl, irregularly spaced; 8⅞" lg x 2½" wd x ⅛" thk; molded phenolic xxx bakelite; 5 #31 (.120) drill mtg holes, 4 on 8½" x 1½" mtg centers 1 on centerline	To support circuit components R-309, R-310, R-311, R-312, R-314, R-315, R-321, R-323, R-324, R-337, R-338, R-341, R-342, R-343, C-303, C-307, C-308, C-312, C-318	Lavoie Lab Part B-1367334	Lavoie Lab B-1367334
E-305		BOARD, terminal: resistor binding post strip; 4 solder lug term; brass, silver pl; each pair on 1⅞" centers; 2½" lg x 1½" wd x ⅛" thk; molded phenolic xxx bakelite; two #31 (.120) drill mtg holes on 1" centers	To support circuit components R-332, R-333	Lavoie Lab Part A-1367340	Lavoie Lab A-1367340
E-306	3300-387257418 3Z770-20.8	BOARD, terminal: resistor binding post strip; 20 solder lug term; brass silver pl; 10 pr on 1⅜" centers; 5⅛" lg x 2" wd x ⅛" thk; molded phenolic xxx bakelite; two #26 (.147) drill mtg holes on 3⅛" centers	To support circuit components R-346, R-347, R-348, R-350, R-351, R-353, R-356, R-357, R-359, R-361	Lavoie Lab Part B-1367344	Lavoie Lab B-1367344
E-307	Not used				
E-308		BOARD, terminal: resistor binding post strip; two solder lug term; brass, silver pl; 1⅜" apart; 2¼" lg x 1½" wd x ⅛" thk; molded phenolic xxx bakelite; two #31 (.120) drill mtg holes 1⅛" x 1⅜" apart; bakelite plate 1/32" thk mtd on back; metal clamp for holding resistors, mts on two #31 (.120) drill holes 1⅛" apart on centerline	To mount resistor R-354	Lavoie Lab Part B-1367367	Lavoie Lab B-1367367
E-309	3300-292241250 R16-K-3442-650 2Z5822-89	KNOB, black molded: 1⅛" diam x ⅝" h; shaft hole ¼" diam x ½" lg; two Allen head, flat point set screws	For adjusting R-358	Harry Davies Mold 4100-B Cut II Style 1	
E-310		KNOB: same as E-309	For adjusting R-360		
E-311	3300-292-241030 R16-K-3373-250 2ZK5822-32	KNOB: black molded, 1⅛" diam x ⅝" h; shaft hole ¼" diam x ½" lg; two Allen head, flat point set screws; #135 brass insert pointer staked on	For adjusting S-302	Harry Davies Mold 4100-B Cut III Style 8	

E-312		KNOB: same as E-311	For adjusting S-303		
E-313		SHIELD, tube: same as E-106	Tube shield for V-308		
E-314	3300-295578993 R16-S-3934 2Z8304.170	SHIELD, tube: durable steel; cylindrical; 1 15/16" lg; complete with tube securing spring; "J" slot	Shield for tube V-301	Cinch 9S2	
E-315		SHIELD, tube: same as E-314	Shield for V-302		
E-316		SHIELD, tube: same as E-104	Tube shield for V-303		
E-317		SHIELD, tube: same as E-104	Tube shield for V-304		
E-318		SHIELD, tube: same as E-104	Tube shield for V-305		
E-319		SHIELD, tube: same as E-104	Tube shield for V-307		
E-320	3300-387256180 3Z770-3.30	BOARD, terminal: 3 silver pl brass solder lug term; term irregularly located; phenolic; 1 3/8" lg x 3/4" wd x 1/2" h; two 0.147" diam mtg holes 1" c to c; moisture-fungus proofed; p/o Army-Navy Signal Generator TS-418A/U	Provides terminals for filter leads	Lavoie Lab Part #A-1367551	Lavoie Lab #A-1367551
E-321	3300-387256269 3Z770-4.69	BOARD, terminal: 4 silver pl brass solder lug term; term located on 1/2" x 9/16" mtg/c; phenolic; 1 3/16" diam x 7/16" thk; two 0.128" diam mtg holes 3/8" c to c; moisture-fungus proofed; p/o Army-Navy Signal Generator TS-418A/U	Provides terminals for transformer leads	Lavoie Lab Part #A-1367552	Lavoie Lab #A-1367552
E-322		BOARD, terminal: same as E-321	Same as E-321		
E-323		BOARD, terminal: same as E-321	Same as E-321		
I-301	3300-291382872 2Z3718.140	DIAL: pulse delay indicating dial; p/o Army-Navy Signal Generator TS-418/U; aluminum disc staked on phenolic knob; 2 1/4" diam x .063" thk disc on knob 1 1/8" diam x 5/8" thk; mts to .250" diam shaft by two #8-32 set screws; marked 3-300 microseconds on circum	Indicated delay of RF pulse output signal	Lavoie Lab Part #A-1367070	Lavoie Lab #A-1367070
I-302	3300-291382873 2Z3718.141	DIAL: pulse width indicating; p/o Army-Navy Signal Generator; aluminum disc staked to phenolic knob; 2 1/4" diam x .063" thk, W/Knob 1 1/8" diam x 5/8" thk; mts to .250" diam shaft by two #8-32 set screws 90 deg apart; one scale 0-10 usec counterclockwise on circum	Indicated width of RF pulse output signal	Lavoie Lab Part #A-1367069	Lavoie Lab #A-1367069
I-303	3300-291382871 2Z3718.139	DIAL: pulse rate indicating dial; p/o Army-Navy Signal Generator TS-418/U; aluminum disc staked on phenolic knob; 2 1/4" diam x .063" thk disc on knob 1 1/8" diam x 5/8" thk; mts to .250 diam shaft by two #8-32 set screws; marked 40—400 cyc; counterclockwise	Indicates repetition rate of RF pulse output signal	Lavoie Lab Part #A-1367071	Lavoie Lab #A-1367071
J-302	3300-308950650 R16-F-2040 3C4025	CONNECTOR, female contact: single round female cont; straight type; 3 1/4" lg x 3/4" o/a; cylindrical brass body, silver pl; polystyrene insert; 1 1/16" x 1 1/16" mtg base, four mtg holes tapped for #4-40 screws; includes RF filter, 2 3/4" lg x 1/2" diam o/a, brass, silver pl; mts to connector base with 3/4" square flange, 4 mtg holes tapped for 3-56 screws	SYNC IN jack	Lavoie Lab Part #B-1367310	Lavoie Lab #B-1367310
J-303		CONNECTOR: same as J-302	SYNC OUT jack		
J-304		CONNECTOR: same as J-302	EXT MOD jack		
J-305		CONNECTOR: same as J-302	DELAYED SYNC OUT jack		

TABLE 6-1.—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No
L-301		Not used			
M-301	3300-326476525 R16-M-1919-10 3F3307.33	METER, audio level: —6 to +3 db; round, metal, flush mtg HS case; 1.433" lg x 2.695" diam; 2% accuracy D'Arsonval movement; calibrated for non-magnetic panel; 13 scale divisions; black numerals, white background; self contained; three 4-40 x 5/8" round head mts s screws; 120° apart on rad; two solder lug term; Marion Elec Instr Model HM2 w/spcl scale	Monitors RF Output	Lavoie Lab Part #B-1367416	Lavoie Lab #B-1367416
O-301	3300-298303130 R16-AN-CW-123/U 2Z3350-123	CAP: Army-Navy Cap CW-123/U, cover for UG-290/U connector; brass silver pl; no dimension larger than 1"; held to front of set by chain 2½" lg, eyelet each end	Cover for Jack J-302	CW-123/U	Navy Dwg RE49F331
O-302		CAP: same as O-301	Cover for Jack J-303		
O-303		CAP: same as O-301	Cover for Jack J-304		
O-304		CAP: same as O-301	Cover for Jack J-305		
O-305		RETAINER, tube: same as O-101	Lock for V-306		
R-303	3300-381366220 R16-R17347-15-100 3RC31BF104K	RESISTOR, fixed: comp; 100,000 ohms ±10%; 1 w; 1.28" lg x .310" diam; two axial wire leads	Plate load resistor for V-301A	JAN RC313BF104K	JAN-R-11
R-304		RESISTOR, fixed: same as R-108	Grid resistor for V-301A		
R-305	3300-381217080 R16-R-17268-25-500 3RC21BF152K	RESISTOR, fixed: comp; 1500 ohms ±10%; ½ w; .655" lg x .249" diam; two axial wire leads	Provides grid cathode bias for V-301A	JAN RC21BF152K	JAN-R-11
R-306	3300-381216160 R16-R-17310-1-500 3RC21BF103K	RESISTOR, fixed: comp; 10,000 ohms ±10%; ½ w; .655" lg x .249" diam; two axial wire leads	Provides discharge path for C-301	JAN RC21BF103K	JAN-R-11
R-307	3300-381219800 R16-R-17331-75-500 3RC21BF473K	RESISTOR, fixed: comp; 47,000 ohms ±10%; ½ w; .655" lg x .249" diam; two axial wire leads	Provides grid cathode bias for V-301B	JAN RC21BF473K	JAN-R-11
R-308	3300-381568960 R16-R-17327-58 3RC41BF333K	RESISTOR, fixed: comp; 33,000 ohms ±10%; 2 w; 1.78" lg x .405" diam; two axial wire leads	Plate load resistor for V-301B	AB HB 3331	
R-309	3300-381369860 R16-R-17354-14-224 3RC31BF474K	RESISTOR, fixed: comp; 470,000 ohms ±10%; 1 w; 1.28" lg x .310" diam; two axial wire leads	P/O grid resistance for V-302A	JAN RC31BF474K	JAN-R-11
R-310		RESISTOR, fixed: same as R-108	P/O grid resistance for V-302A		
R-311	3300-381216280 R16-R-17375-5 3RC21BF105K	RESISTOR, fixed: comp; 1 meg ±10%; ½ w; .655" lg x .249" diam; two axial wire leads	P/O grid resistance for V-302A	JAN RC21BF105K	JAN-R-11

R-312	3300-381167120 R16-R-17310-59-100 3RC20BF153J	RESISTOR, fixed: comp; 15,000 ohms ±5%; ½ w; .468" lg x .249" diam; two axial wire leads	Determines high freq end on X1 and X10 ranges	JAN RC20BF153J	JAN-R-11
R-313	3300-394387590 R16-P-5592-5-500 3Z7498-20.20	RESISTOR, variable; 200,000 ohms ±10%; 2 w; 500 V max; 1 1/16" diam x 9/16" lg; shaft .250" diam x 7/8" lg; lin taper; three term	Provides variation of pulse freq	AB JS2041-P3056	
R-314		RESISTOR, fixed: same as R-306	Provides positive bias for V-302B		
R-315	3300-381216220 R16-R-17345-5 3RC21BF104K	RESISTOR, fixed: comp; 100,000 ohms ±10%; ½ w; .655" lg x .249" diam; two axial wire leads	Plate load for V-302A	JAN RC21BF104K	JAN-R-11
R-316	3300-380057040 R16-P-6893-100 3RA5704	RESISTOR, variable; wire wound; 1000 ohms ±10%; 2 w; no switch; normal torque; slotted shaft ½" lg; lin taper; 1.47" lg x 1.78" diam	Plate load for V-302A on X10	JAN RA30A1SA102AK	JAN-R-19
R-317		RESISTOR, variable: same as R-316	Plate load for V-302A on X1		
R-318	3300-381218960 R16-R-17327-3 3RC21BF333K	RESISTOR, fixed: comp; 33,000 ohms ±10%; ½ w; .655" lg x .248" diam; two axial wire leads	Plate load for V-303A	JAN RC21BF333K	JAN-R-11
R-319	3300-381217980 R16-R-17262-55-43 3RC21BF221J	RESISTOR, fixed: comp; JAN type #RC21BF221J; 220 ohms ±5%; ½ w; .655" lg x .249" diam; two axial wire leads	Determines minimum delay	JAN RC21BF221J	JAN-R-11
R-320	3300-399811524 R16-P-5593-38-375 3Z7498-25.44	RESISTOR, variable: 250,000 ohms ±10%; 2 w; 500 V max; 1 1/16" diam x 9/16" lg; shaft 7/8" lg x .250" diam; lin taper; three term	Provides variation of pulse delay	AB JA2541-P3056	
R-321	3300-381367080 R16-R-17268-30-100 3RC31BF152K	RESISTOR, fixed: comp; 1500 ohms ±10%; 1 w; 1.28" lg x .310" diam; two axial wire leads	Maintains grid voltage of V-303A	JAN RC31BF152K	JAN-R-11
R-322	3300-392530860 R16-R-18689-249 3Z6615-77	RESISTOR, fixed: wire wound; 15,000 ohms ±5%; 30 w at 250°C max operating temp; 3" lg x 9/16" diam; IRC type B cement coating; two solder lug term	Plate load of V-302B	IRC DJ	
R-323	3300-381217180 R16-R-17348-15-100 3RC21BF154J	RESISTOR, fixed: 150,000 ohms, ±5%; ½ w; .468" lg x .249" diam; two axial wire leads	Grid resistor for V-304B	JAN RC21BF154J	JAN-R-11
R-324		RESISTOR, fixed: same as R-311	Couples bias to V-304B		
R-325		RESISTOR, fixed: same as R-306	Provides discharge path for C-313		
R-326		RESISTOR, fixed: same as R-201	Cathode resistor for sync out tube		
R-327	3300-381217260 R16-R-17383-100 3RC21BF155K	RESISTOR, fixed: comp; 1.5 meg ±10%; ½ w; .655" lg x .249" diam; two axial wire leads	Maintains grid at potential of R-344 and R-345	JAN RC21BF155K	JAN-R-11
R-328		RESISTOR, fixed: same as R-306	Plate load of V-305A		
R-329	3300-381569740 R16-R-17281-179-500 3RC41BF472K	RESISTOR, fixed: comp; 4700 ohms ±10%; 2 w; 1.78" lg x .405" diam; two axial wire leads	Plate load of V-305B	AB HB4721	

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TABLE 6-1.—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
R-330		RESISTOR, fixed: same as R-315	Maintains grid at potential of R-344 and R-345		
R-331	3300-385303220 R16-R-18687-85 3RW30322	RESISTOR, fixed: WW; 10,000 ohms ±5%; 9 w; 3" lg x $1\frac{19}{32}$" diam; ins, inductive; two tab term	Determines screen potential of V-306	JAN RW34C103	JAN-R-26
R-332	3300-385243180 R16-R-18654-105 3RW24318	RESISTOR, fixed: WW; 1000 ohms ±5%; 5 w; $2\frac{3}{16}$" lg x $\frac{5}{8}$" diam; ins, inductive; two tab term	P/O coupling impedance between V-306 and V-201	JAN RW50J102	JAN-R-26
R-333		RESISTOR, fixed: same as R-332	Same as R-332		
R-334	3300-399809042	RESISTOR, variable: 50,000 ohms ±5%; 2 w; $\frac{9}{16}$" lg x $1\frac{1}{16}$" diam; shaft $\frac{7}{8}$" lg x .250" diam; JAN-C taper; three term	Provides variation of pulse width	AB JA5 031-P3056	
R-335	3300-294445070 R16-P-5583-7-400 2ZK7262-5M.6	RESISTOR, variable: 5000 ohms ±10%; 2 w; $1\frac{3}{16}$" lg x $1\frac{1}{16}$" diam; shaft $\frac{5}{8}$" lg x .250" diam; lin taper; three term	Determines minimum end of pulse width range	AB JLU5021-SD4040L	
R-336		RESISTOR, fixed: same as R-311	Part of grid resistance for V-302A		
R-337		RESISTOR, fixed: same as R-323	Grid resistor for V-307		
R-338		RESISTOR, fixed: same as R-311	Couples bias to V-307		
R-339		RESISTOR, fixed: same as R-201	Cathode resistor for delayed sync out tube		
R-341	3300-381568880 R16-R-17327-53 3RC41BF332J	RESISTOR, fixed: comp; 3300 ohms ±5%; 2 w; 1.78" lg x .405" diam; two axial wire leads	P/O voltage divider which provides bias for V-302A	AB HB3325	
R-342		RESISTOR, fixed: same as R-341	Same as R-341		
R-343	3300-381170500 R16-R-17264-56-17 3RC20BF681J	RESISTOR, fixed: comp; 680 ohms ±5%; ½ w; .468" lg x .249" diam; two axial wire leads	Same as R-341	JAN RC20BF681J	JAN-R-11
R-344	3300-381219840 R16-R-17354-14-170 3RC21BF474J	RESISTOR, fixed: comp; 470,000 ohms ±5%; ½ w; .655" lg x .240" diam; two axial wire leads	P/O voltage divider which provides bias for V-305A and V-305B	JAN RC21BF474J	JAN-R-11
R-345	3300-381218160 R16-R-17352-1-14 3RC21BF224J	RESISTOR, fixed: comp; 220,000 ohms ±5%; ½ w; .655" lg x .249" diam; two axial wire leads	Same as R-344	JAN RC21BF224J	JAN-R-11
R-346	3300-390471085 R16-R-17262-55-107 3Z6024-15	RESISTOR, fixed: comp; 240 ohms ±2%; ½ w; temp coef of resistance will not exceed .0005 neg; $\frac{9}{32}$" x $\frac{5}{8}$"; special rubberized enamel ins	Arm of monitor bridge network	Concarbon X ½ 240 ohms ±2%	

R-347	3300-389816717 R16-R-17257-110 3Z6002B2-28	RESISTOR, fixed: comp; 22 ohms ±2%; ½ w; temp coef of resistance will not exceed .0005 neg; 9/32" x 5/8"; special rubberized enamel ins	Component of RF monitor temp compensating circuit	Concarbon X ½ 22 ohms ±2%	
R-348		RESISTOR, fixed: same as R-346	Same as R-347		
R-349	3300-394186098 R16-T-2271 3Z6926-17	RESISTOR, thermal: disc thermistor; 803 ohms ±5% at 75° F; 1¼" lg x 7/8" wd x 5/16" thk; mts by four .187" diam mtg holes on 1.000" x .625" ctr; p/o Army-Navy Signal Generator TS-418/U, modified from WECO #D-168392 by enlarging mtg holes	Component of RF monitor temperature compensating circuit	Lavoie Lab Part #A-1367471	Lavoie Lab #A-1367471
R-350		RESISTOR, fixed: same as R-346	Same as R-346		
R-351		RESISTOR, fixed: same as R-346	Same as R-346		
R-352		RESISTOR, fixed: same as R-311	Grid resistor for V-304A		
R-353	3300-389902690 R16-R-17258-53-8 3Z6003J9-1	RESISTOR, fixed: comp; 39 ohms ±2%; ½ w; 9/32" x 5/8"; temp coef will not exceed .0005" neg; special rubberized enamel ins	Same as R-347	Concarbon X ½ 39 ohms ±2%	
R-354		RESISTOR, fixed: same as R-118	Provides DC voltage for monitor bridge circuit		
R-355	3300-394186070 R16-T-2265 3Z6926-11	RESISTOR, thermal: disc thermistor; 765 ohms at 75° F ±5%; rectangular metal mtg plate 1¼" lg x 7/8" wd; 5/16" h; wire lead 4" lg	Same as R-349	WECO D168391	
R-356	3300-390784282 R16-R-17263-58-50 3Z6047-28	RESISTOR, fixed: comp; 470 ohms ±2%; ½ w; 9/32" x 5/8"; temp coef will not exceed .0005" neg; special rubberized enamel ins	Same as R-347	Concarbon X ½ 470 ohms ±2%	
R-357	3300-389892088 R16-R-17258-52-36 3Z6003F6-11	RESISTOR, fixed: comp; 36 ohms ±2%; ½ w; 9/32" x 5/8"; temp coef of resistance will not exceed .0005" neg; special rubberized enamel ins	Same as R-347	Concarbon X ½ 36 ohms ±2%	
R-358	3300-380066180 R16-P-6905-420 3RA6618	RESISTOR, variable: 3500 ohms ±10%; 4 w; no switch; normal torque; 1.47" lg x 1.78" diam; ½" lg slotted shaft; lin taper; three solder lug term	ZERO SET control	JAN RA30A1RD- 352AK	JAN-R-19
R-359		RESISTOR, fixed: same as R-323	Determines low end of DC		
R-360	3300-399811533 R16-P-5593-35-500 3Z7498-25.33	RESISTOR, variable: 250,000 ohms ±10%; 2 w; 2 9/16" lg x 1 1/16" diam; shaft 7/8" lg x .250" diam; lin taper; three term	Provides variation of cavity plate voltage	AB JU2541-P3056	
R-361	3300-381216200 R16-R-17344-190-100 3RC21BF104J	RESISTOR, fixed: comp; 100,000 ohms ±5%; ½ w; .655" lg x .240" diam; two axial wire leads	Determines high voltage end of regulated DC output	JAN RC20BF104J	JAN-R-11
R-362	3300-381518120 R16-R-17310-178-500 3RC41BF223K	RESISTOR, fixed: comp; 22,000 ohms ±10%; 2 w; 1.78" lg x .405" diam; two axial wire leads	Plate load for V-304A	AB HB2231	
R-363	3300-381516100 R16-R-17265-70-975 3RC41BF102K	RESISTOR, fixed: comp; 1000 ohms ±10%; 2 w; 1.78" lg x .405" diam; two axial wire leads	Part of RC Filter	AB HB1021	

TABLE 6-1.—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
R-364		RESISTOR, fixed: same as R-363	Part of RC Filter		
R-365		RESISTOR, fixed: same as R-203	Damping resistor for pulse rate blocking oscillator transformer		
R-366		RESISTOR, fixed: same as R-311	Grid resistor for inverter tube V-307B		
R-367		RESISTOR, fixed: same as R-362	Plate resistor for inverter tube V-307B		
S-302	3300-395499465 R17-S-25517-25 3Z9825-62.273	SWITCH, rotary: double pole 5 position; 3 sect; silver pl brass cont; phenolic body; 2 7/8" lg x 1 7/8" wd x 9/16" h; solder lug term; mts by 3/8" diam by 3/8-32" bushing	Selects the proper sync and/or modulation voltages	Oak Part No. 39300-DH3	Lavoie Lab #A-1367021
S-303		SWITCH, rotary: same as S-302	Same as S-302		
S-304	3300-395852800 R17-S-28255-9 3Z9863-12A	SWITCH, toggle: SPST; black phenolic body; 1 9/32" lg x 9/16" h x 31/32" wd; two solder lug term; mts by 3/8" diam by 3/8-32" bushing	For application of DC plate voltage to RF Oscillator tube V-201	AH & H 82301-B	
T-301	3300-296949062 R16-T-6951-475 2Z9627-120	TRANSFORMER, pulse: blocking osc 40 to 4000 pps, 0.5 to 10 us; #1 wnd 98 ohm imped 5.08 ohm DC resistance, #2 wnd 95 ohm imped 3.65 ohm DC resistance; #1 wnd 93v 316 ma, #2 wnd 80v 25 ma; 2500 v ins; HS metal case; 2 1/32" lg o/a x 1 1/32" diam; vacuum impr w/ZOPHAR #1592 hard wax; 4 solder lug term on mtg end; two #4-40 tapped holes on 3/8" ctr on end	Blocking oscillator transformer	Lavoie Lab Part #B-1367325	Lavoie Lab #B-1367325 and JAN-T-27
T-302		TRANSFORMER, pulse: same as T-301	Sync out blocking oscillator transformer		
T-303		TRANSFORMER, pulse: same as T-301	Delayed sync out blocking oscillator transformer		
V-301	3300-234942400 16-T-58241-60 2J12AX7	TUBE, electron: miniature Hi-Mu twin triode; 9 pin	Prepares sync for pulse generator	JAN 12AX7	JAN-1-A
V-302	3300-234942000 16-T-58240-10 2J12AT7	TUBE, electron: twin triode, 9 pin	Internal pulse rate generator and diode clipper	JAN 12AT7	JAN-1-A
V-303		TUBE, electron: same as V-103	One shot delay multivibrator		
V-304		TUBE, electron: same as V-103	Sync out amplifier		
V-305		TUBE, electron: same as V-103	P/O width multivibrator and ext mod pulse inverter		

V-306		TUBE, electron: same as V-104	P/O width multivibrator and modulator tube		
V-307		TUBE, electron: same as V-103	Delayed sync out amplifier		
X-301	3300-295957379 R16-S-6188-280 2Z8679.28	SOCKET, tube: 9 cont miniature; one piece saddle mtg; two 1/8" diam mtg holes on a 1 1/8" mtg ctr; cylindrical ceramic 15/16" diam x 3/4" h excluding cont; beryllium copper silver pl cont; miniature type w/metal ctr shield 3/16" diam; Cinch Mfg. Corp.	Socket for Tube V-301	[illegible]	
X-302		SOCKET, ceramic: same as X-301	Socket for tube V-302		
X-303		SOCKET, tube: same as X-103	Socket for V-303		
X-304		SOCKET, tube: same as X-103	Socket for V-304		
X-305		SOCKET, tube: same as X-103	Socket for V-305		
X-306		SOCKET, tube: same as X-101	Socket for V-306		
X-307		SOCKET, tube: same as X-103	Socket for V-307		
Z-301	3300-308413505 R16-C-27658 3C1084G1-5	NETWORK, pulse forming: 259 mh inductance; no dimension greater than 1"; 250 turns of #38 single nylon covered enamel wire wound on JAN type RC20BF332J resistor	Acts as damped peaking coil at minimum delay	Lavoie Lab Part #B-1367322	Lavoie Lab #B-1367322
††Z-302		FILTER, low pass: same as Z-203	Same as Z-203		
††Z-303		FILTER, low pass: same as Z-203	Same as Z-203		
††Z-304		FILTER, low pass: same as Z-203	Same as Z-203		
P-101	8800-032007 R17-P-4455 6Z3150-5	CONNECTOR, plug (female): two "T" shaped cont, polarized; straight type; cylindrical black comp body; 1 29/32" h x 1 17/32" diam; cord hole .296" to .562" diam; w/cord grip; two mtg holes	Terminates one end of power cable assembly W-101	Hubbell 7084	
P-102	8800-114005 R17-P-4457 6Z1727	CONNECTOR, plug (male): two flat tandem blades; straight type; 1 3/4" lg x 1 9/16" diam; cord opening .296" to .562" diam; 10 amps, 250 V; molded plastic body; brass insert; with cord grip	Terminates one end of power cable assembly W-101	Hubbell 7057	
W-101	1600-324759988 R16-AN-CX-337/U 3E6000-337-72	CABLE ASSEMBLY, power: Army-Navy Cable Assy CX-337/U (6'); two #16 AWG stranded conductor, rubber ins, 300 V working, cotton braid, rubber jacket, oval shape, 3/16" x 3/16"; Hubbell #7084 female cont connector on one end, Hubbell #7057 male cont connector on other end	Provides power connector from unit to power source	JAN CX-337/U (6')	
E-205	3300-298296948 R16-A-478 2Z308-273	ADAPTER, connector: Army-Navy UG-273/U; single round male cont; straight type; coaxial adapter BNC Receptacle to UHG receptacle; 1 3/16" lg x 1 1/16" diam; 500 V peak; cylindrical; silver pl brass body	Provides connection between UG-88/U or similar at one end and Navy type 49194 or similar at other end	JAN UG-273/U	Navy Dwg RE49F389
E-206		ADAPTER, connector: same as E-205			
E-207		ADAPTER, connector: same as E-205			
E-208	3300-298296855 R16-A-470 2Z308-201	ADAPTER, connector: Army-Navy UG-201/U; one end male, other end female; one round male, one round female cont; straight type; 1 33/64" lg x 3/4" diam; cylindrical brass; silver pl; polystyrene insert; 5/8"-32 thd mtg	Provides connection between UG-22/U or similar at one end and UG-88/U or similar at other end	JAN UG-201/U	Navy Dwg RE49F389

CONTRACT NOa(s)-9766

TABLE 6-1.—TABLE OF REPLACEMENT PARTS

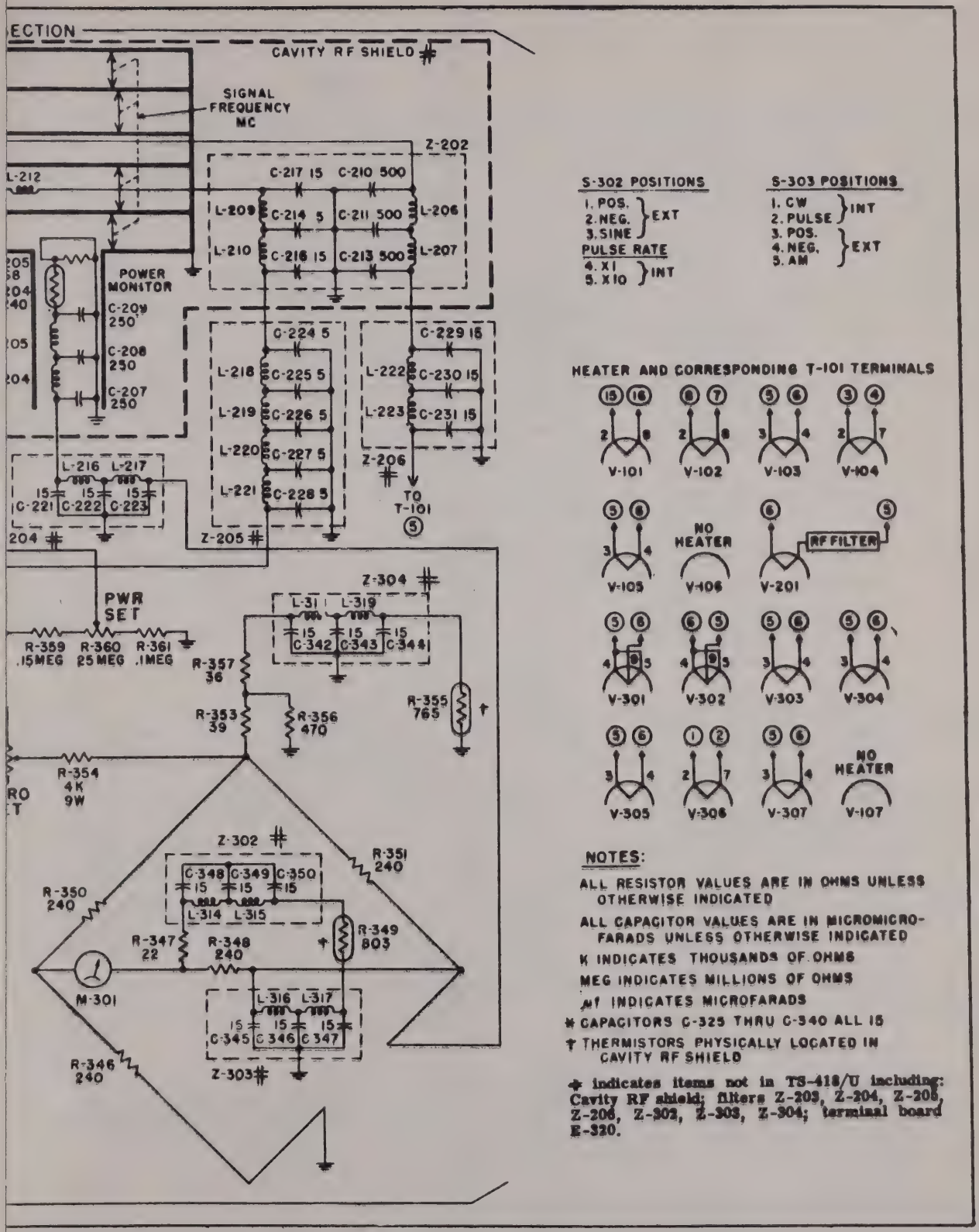
MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
E-209		ADAPTER, connector: same as E-208	Same as E-208		
E-210		ADAPTER, connector: same as E-208	Same as E-208		
E-211	3300-298296928 R16-A-507 2Z308-255	ADAPTER, connector: Army-Navy UG-255/U; RF coaxial adapter; female one end; male other end; round cont one male, one female straight type; 1 5/16" lg x 5/8" diam; 500 V peak; cylindrical; silver pl brass body	Provides connection between UG-290/U or similar at one end and Navy type 49194 or similar at other end	JAN UG-255/U	Navy Dwg RE49F378
E-212		ADAPTER, connector: same as E-211	Same as E-211		
E-213		ADAPTER, connector: same as E-211	Same as E-211		
P-201	8850-468450 R16-P-3627-375	CONNECTOR: Army-Navy UG-88/U; single male cont; straight type 1" lg x 9/16" diam; cylindrical, silver pl brass body; cable opening 1/4" diam; polystyrene insert	Terminates one end of RF transmission line W-201	JAN UG-88/U	Navy Dwg RE49F246
P-202		CONNECTOR: same as P-201	Terminates one end of RF transmission line W-201	JAN UG-88/U	Navy Dwg RE49F246
R-206		RESISTOR, thermal: same as R-204	Same as R-204		
W-203	1600-322981537 3E6015-546.3	LINE, RF transmission: Army-Navy Transmission Line CG-546/U; Army-Navy RF Cable RG-55/U; 6' lg excluding terminations; 6' 2" lg o/a; Army-Navy connector UG-88/U at each end; p/o Signal Generator TS-418/U	Output RF signal coaxial transmission line	JAN CG-546/U (6' 0")	JAN-C-17A and Connector UG-88/U
E-326		LAMP, incandescent: same as E-107	Spare lamp		
E-327		LAMP, incandescent: same as E-107	Spare lamp		
E-328		LAMP, incandescent: same as E-107	Spare lamp		
F-305		FUSE, cartridge: same as F-101	Spare fuse		
F-306		FUSE, cartridge: same as F-101	Spare fuse		
F-307		FUSE, cartridge: same as F-101	Spare fuse		
P-301		CONNECTOR: same as P-201	Terminates one end of RF transmission line W-301		
P-302		CONNECTOR: same as P-201	Terminates one end of RF transmission line W-301		
P-303		CONNECTOR: same as P-201	Terminates one end of RF transmission line W-302		
P-304		CONNECTOR: same as P-201	Terminates one end of RF transmission line W-302		

		RESISTOR, thermal: same as R-204	Same as R-204		
		RESISTOR, thermal: same as R-349	Same as R-349		
		RESISTOR, thermal: same as R-355	Same as R-355		
W-301	1600-322981538 3E6015-546.4	LINE, RF transmission: Army-Navy Transmission Line CG-546/U; Army-Navy Cable RG-55/U; 8′ lg excluding terminations; 8′ 2″ o/a; Army-Navy Connector UG-88/U at each end; p/o Signal Generator TS-418/U	Provides connections to J-302, J-303, J-304, J-305	JAN CG-546/U (8′ 0″)	
W-302		LINE, RF transmission: same as W-301	Same as W-301		
	1600-373056480 R16-C-15879-45 3H772-741	CASE: protective transit case; aluminum case with balsa wood between inner and outer walls; empty; 20 3/16″ lg x 17 1/8″ wd x 17″ h; has accessories box mtd inside cover, rubber bumpers inside case and cover to cushion equipment, holders for cables and instruction books on inner side walls of case; two (2) folding type handles located on ends; p/o Signal Generator TS-418/U	Transit case for instrument and accessories	Lavoie Lab Part #E-1367500	Lavoie Lab #E-1367500

SECTION VII

DRAWINGS



NOTES:

ALL RESISTOR VALUES ARE IN OHMS UNLESS OTHERWISE INDICATED

ALL CAPACITOR VALUES ARE IN MICROMICROFARADS UNLESS OTHERWISE INDICATED

K INDICATES THOUSANDS OF OHMS

MEG INDICATES MILLIONS OF OHMS

μf INDICATES MICROFARADS

* CAPACITORS C-325 THRU C-340 ALL 15

† THERMISTORS PHYSICALLY LOCATED IN CAVITY RF SHIELD

# indicates items not in TS-418/U including: Cavity RF shield; filters Z-203, Z-204, Z-205, Z-206, Z-302, Z-303, Z-304; terminal board E-320.

Figure 7-1. Signal Generator TS-418/U, Schematic Diagram

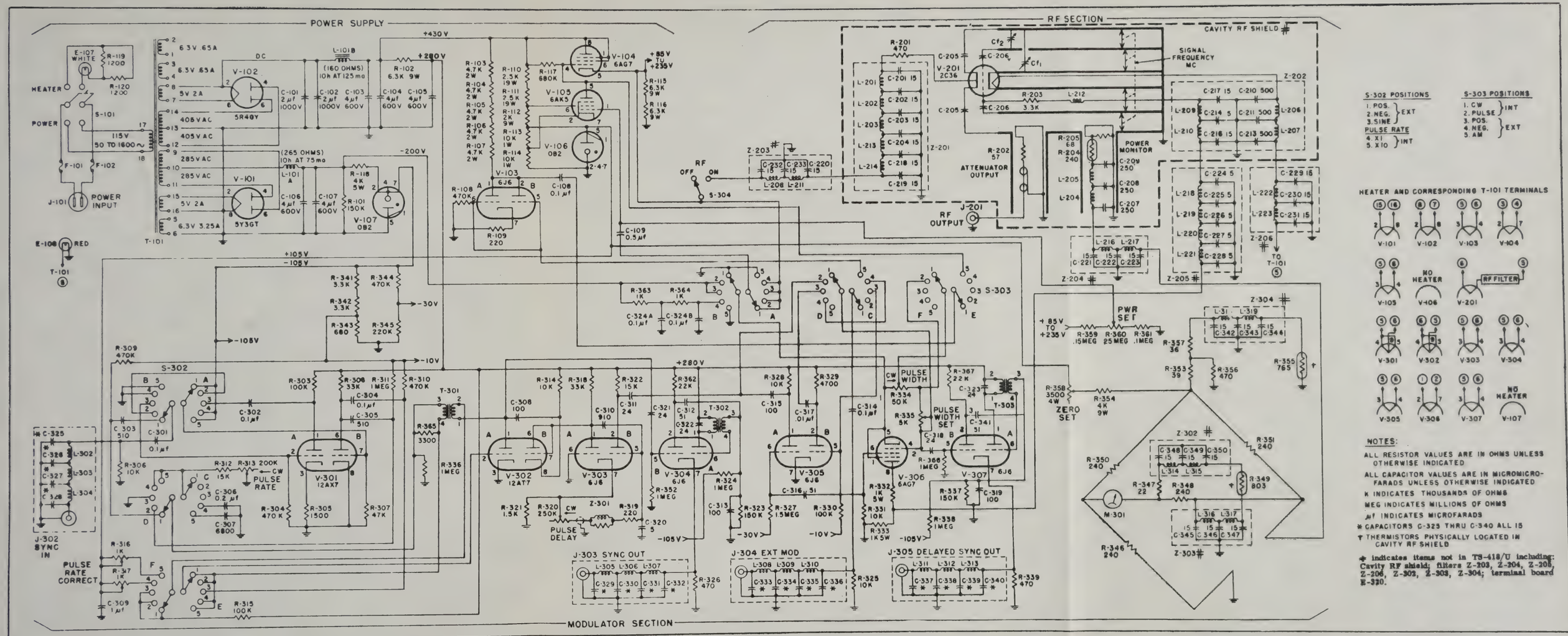
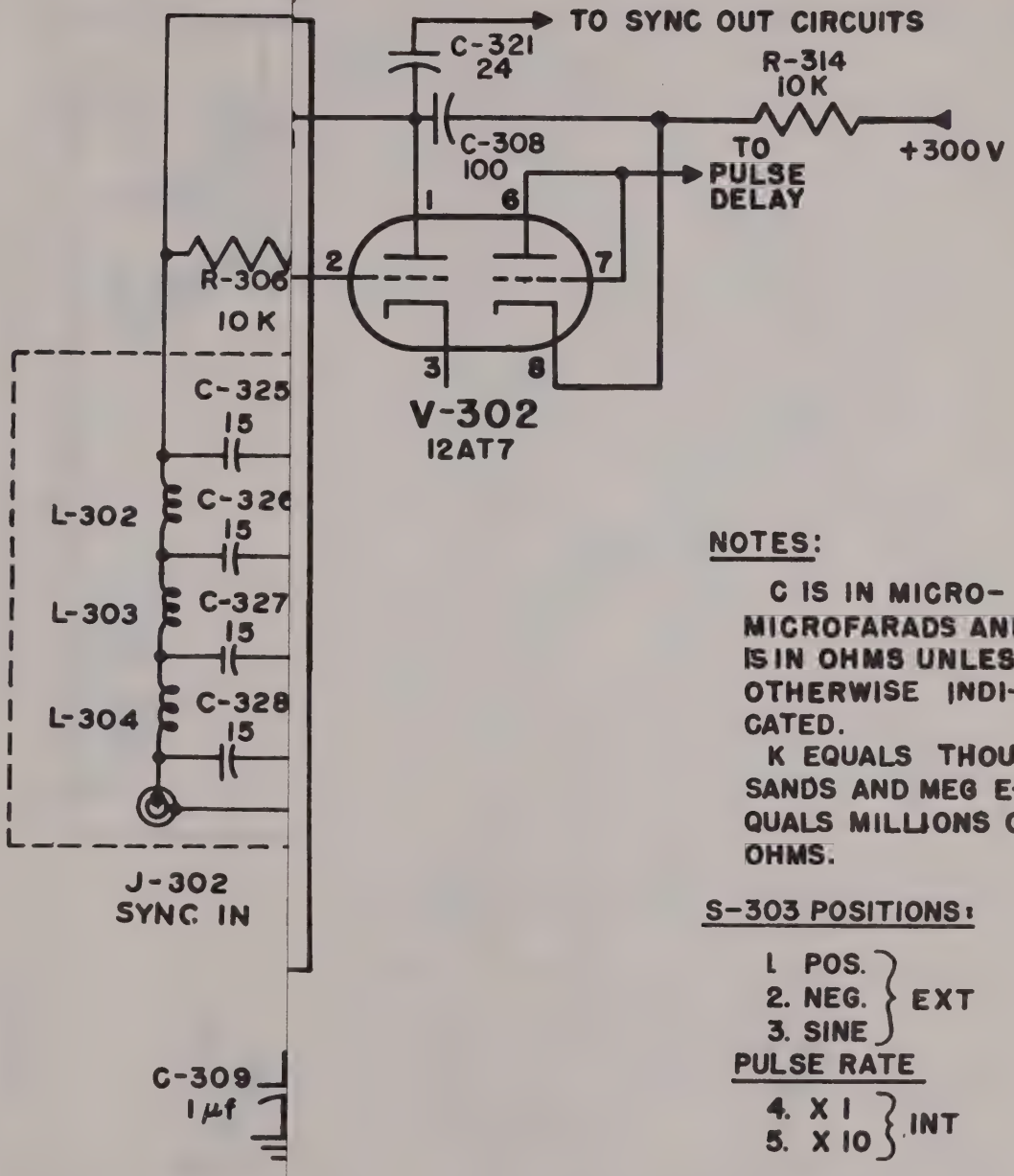
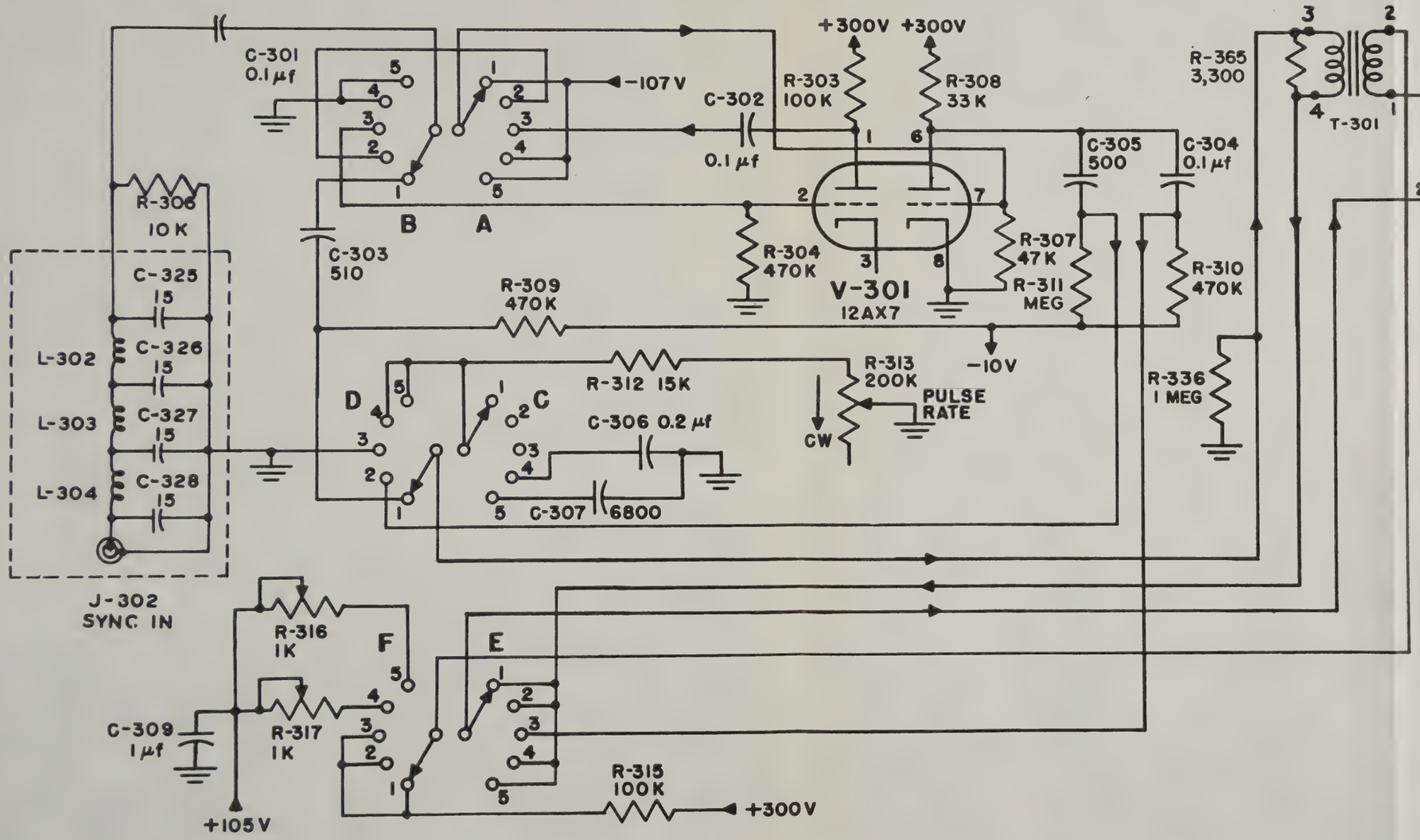


Figure 7-1. Signal Generator TS-418/U, Schematic Diagram



Simplified Schematic of SYNC SELECTOR Switch S-302

AN 16-35TS418-3



NOTES:

C IS IN MICRO-MICROFARADS AND R IS IN OHMS UNLESS OTHERWISE INDICATED.

K EQUALS THOUSANDS AND MEG EQUALS MILLIONS OF OHMS.

S-303 POSITIONS:

1. POS.
2. NEG.
3. SINE

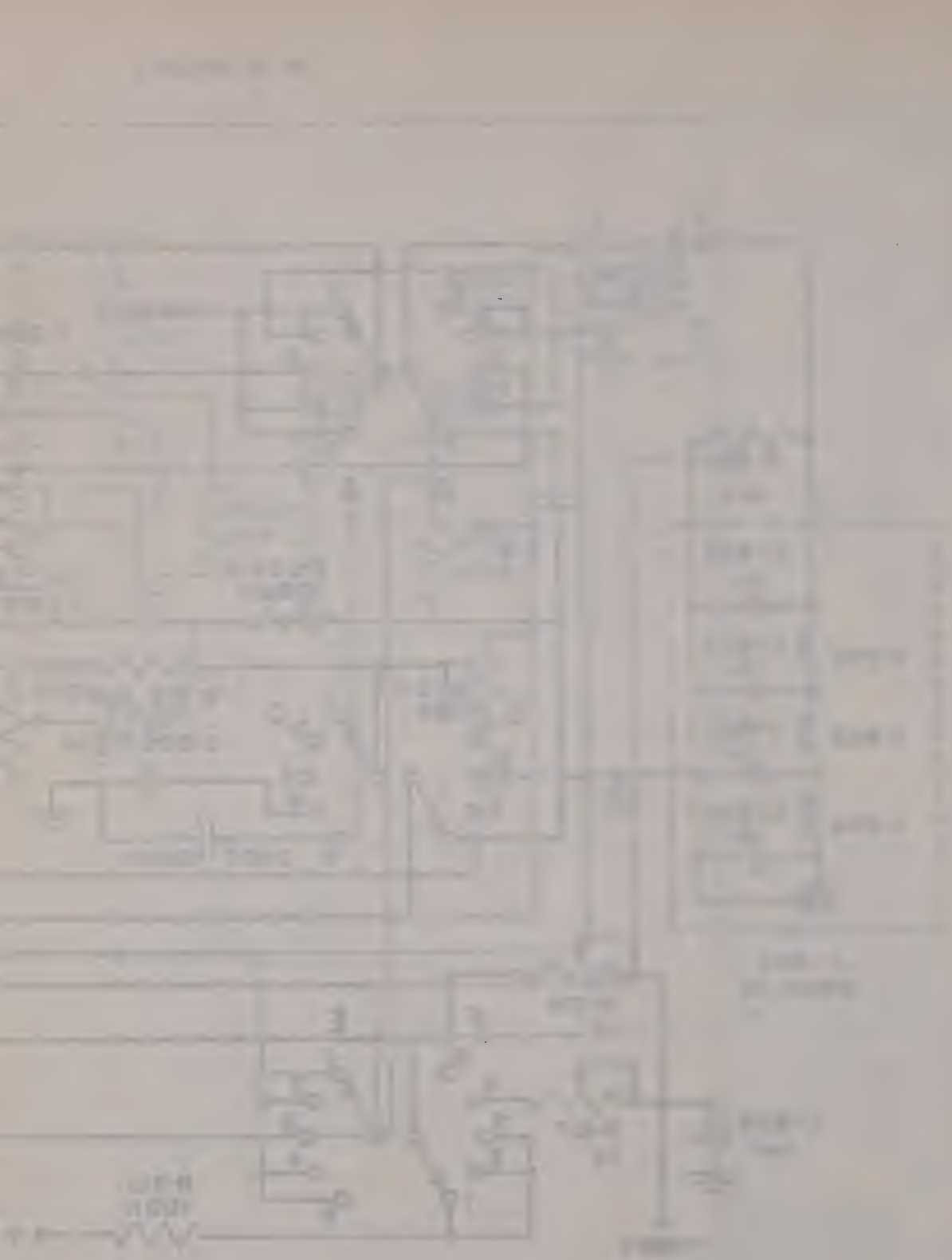
} EXT

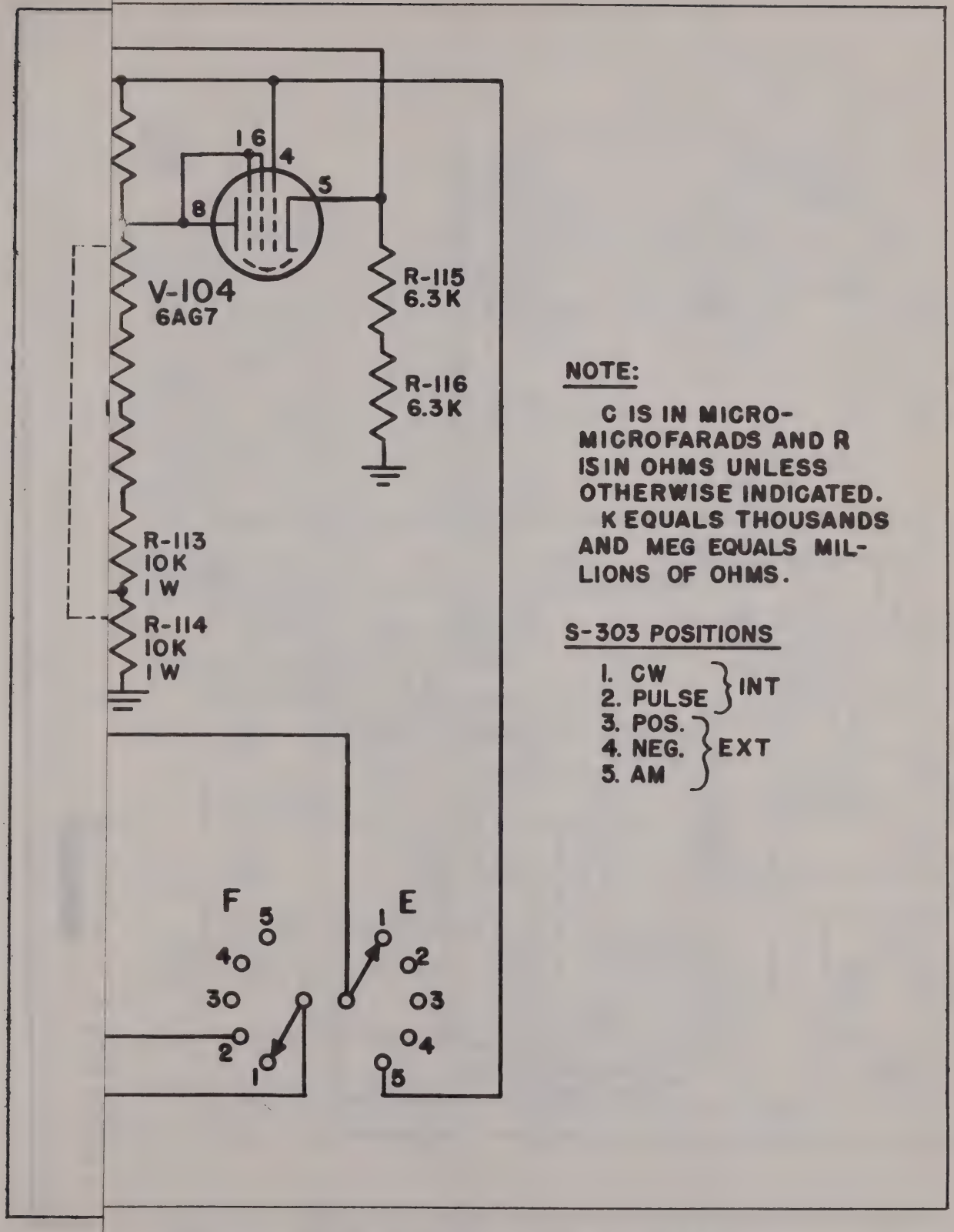
PULSE RATE

4. X 1
5. X 10

} INT

Figure 7-2. Simplified Schematic of SYNC SELECTOR Switch S-302





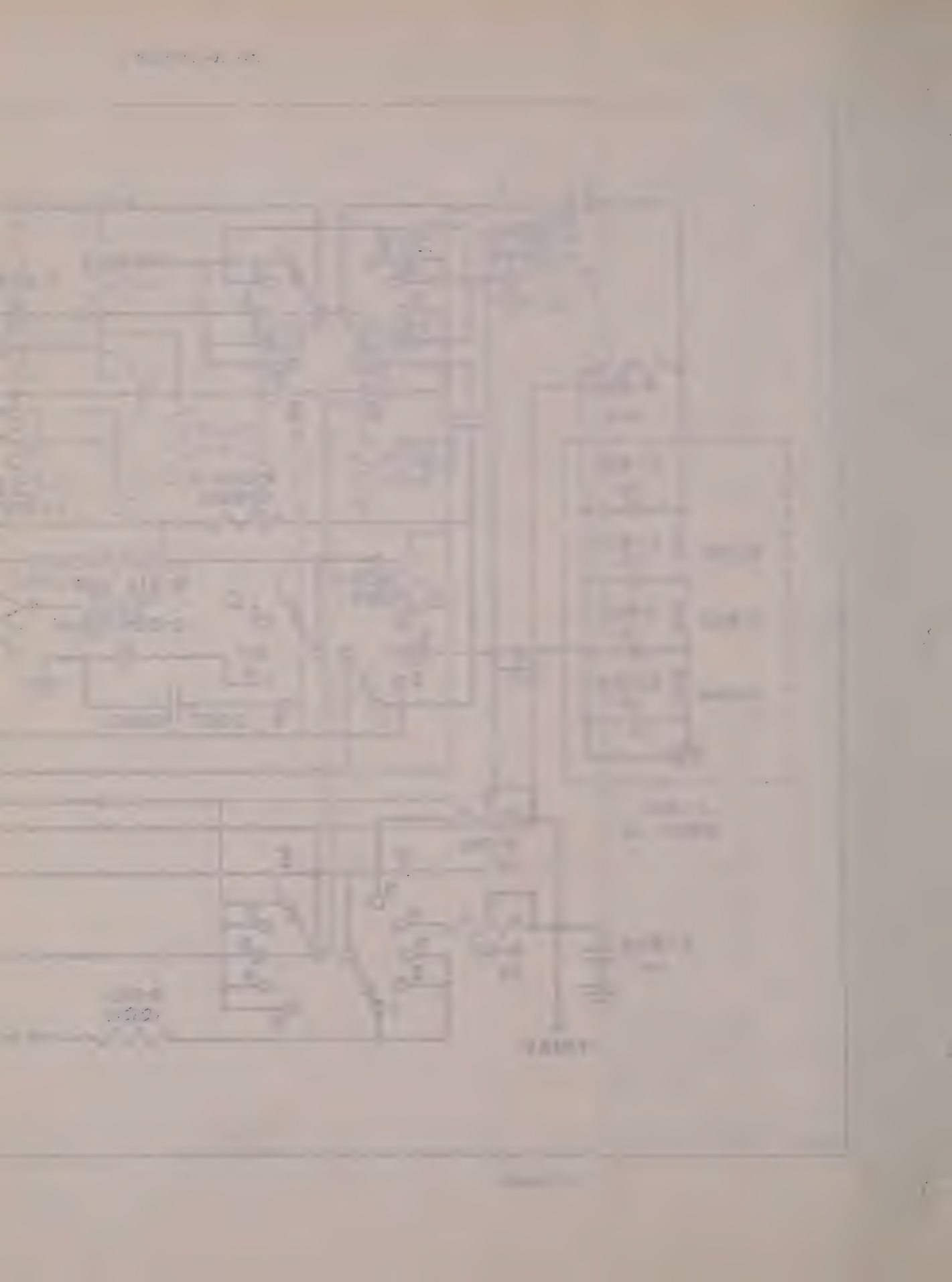
NOTE:

C IS IN MICRO-MICROFARADS AND R IS IN OHMS UNLESS OTHERWISE INDICATED.
K EQUALS THOUSANDS AND MEG EQUALS MILLIONS OF OHMS.

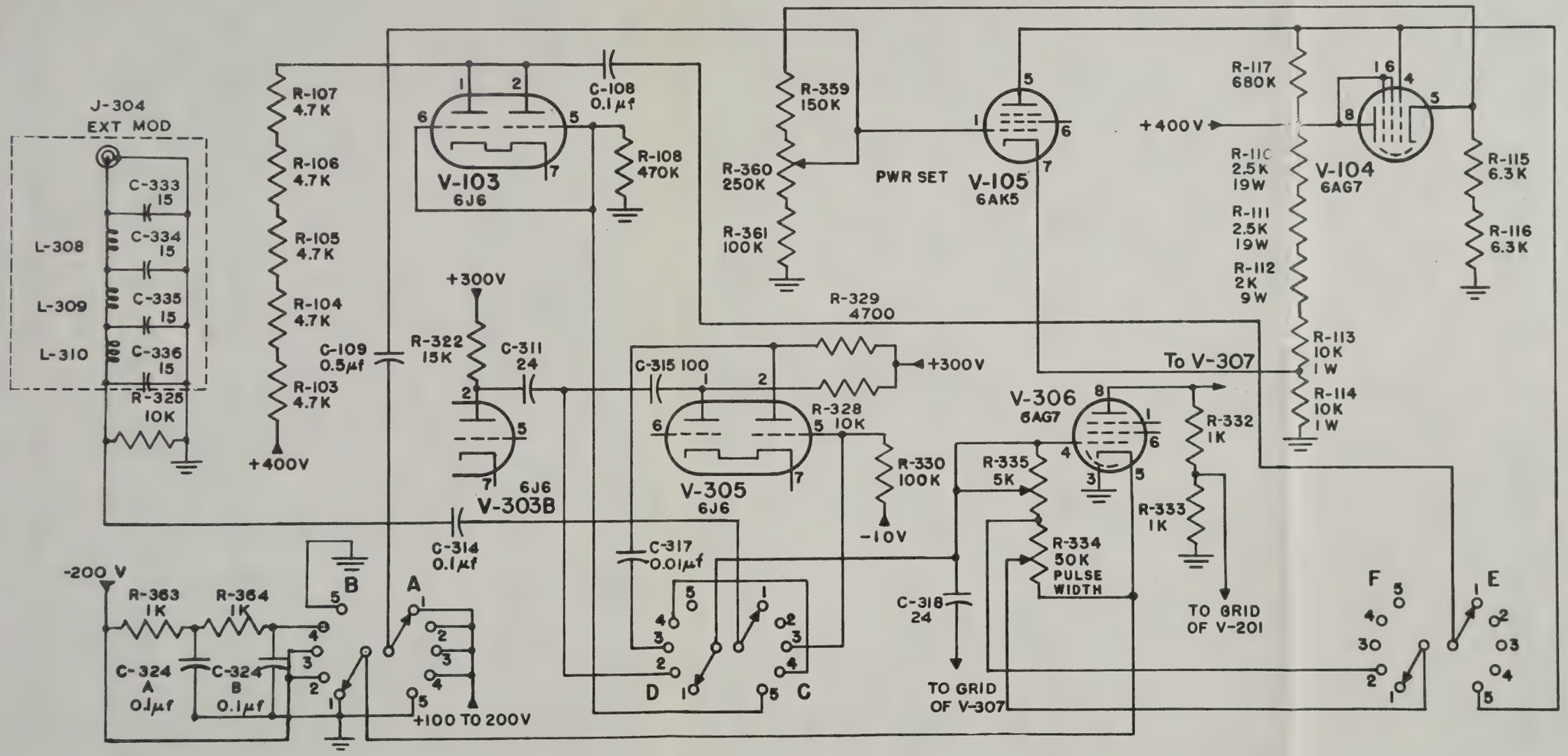
S-303 POSITIONS

1. CW } INT
2. PULSE }
3. POS. } EXT
4. NEG. }
5. AM }

Figure 7-3. Simplified Schematic of MOD SELECTOR Switch S-303



AN 16-35TS418-3



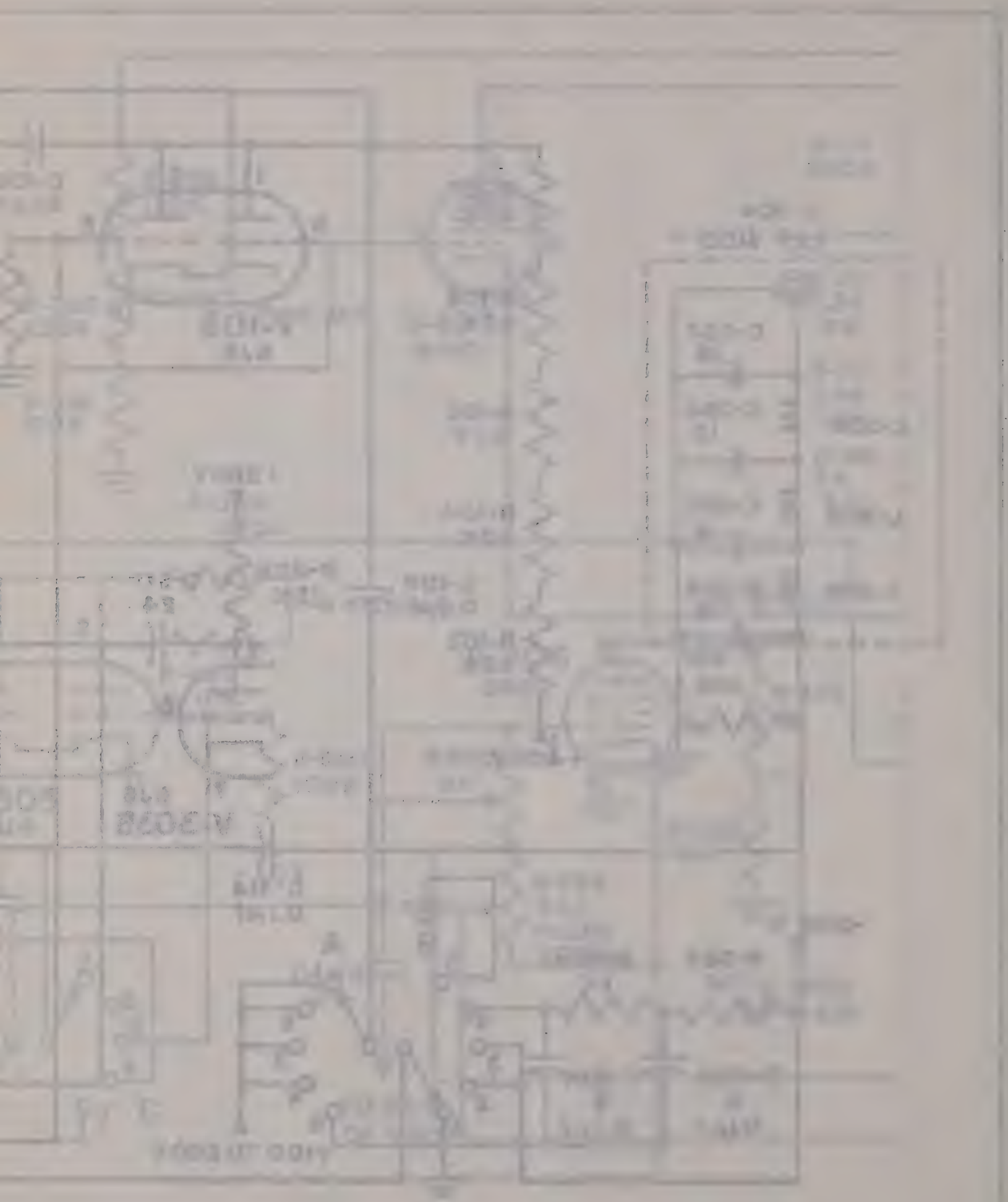
NOTE:

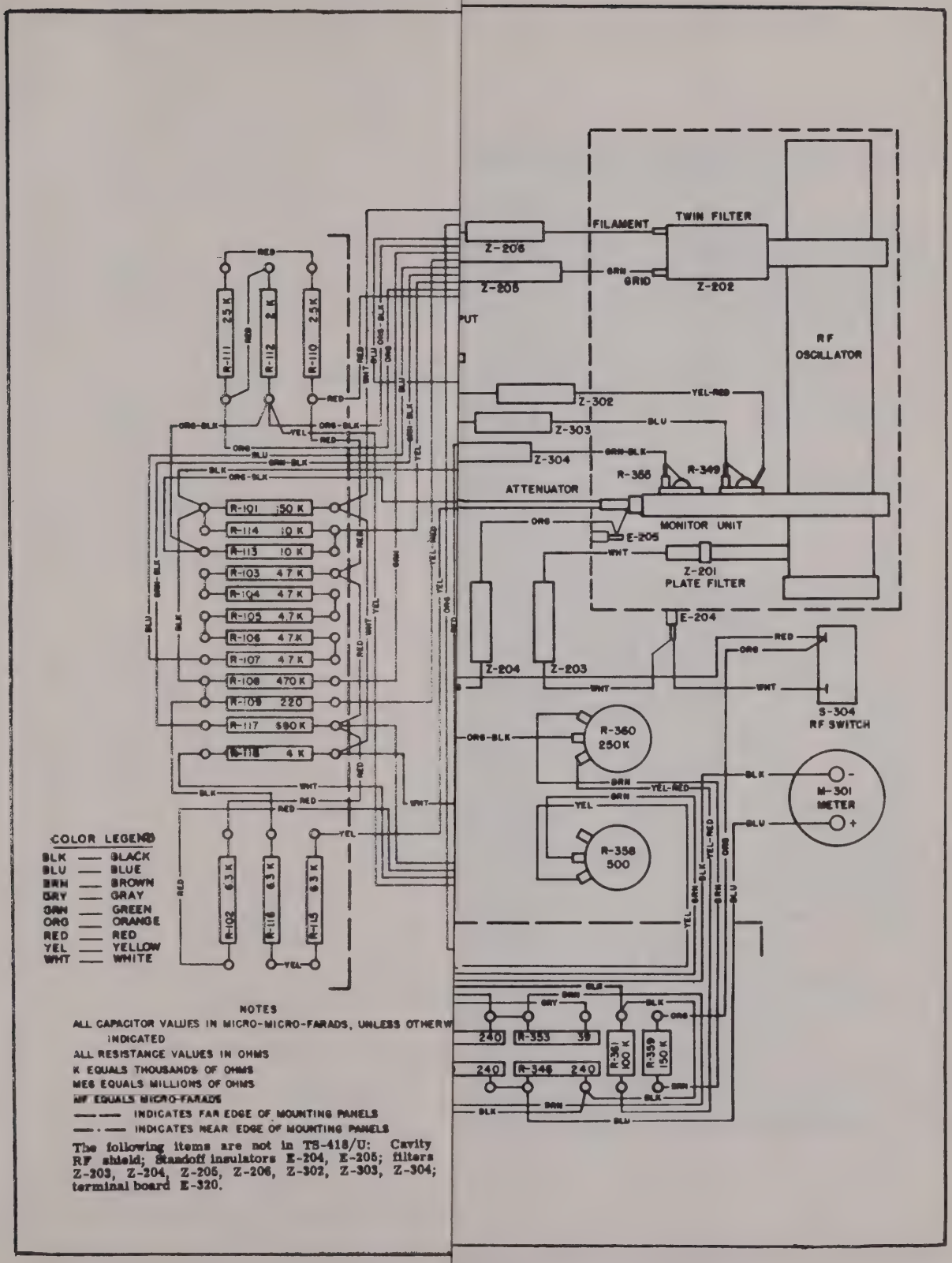
C IS IN MICRO-MICROFARADS AND R ISIN OHMS UNLESS OTHERWISE INDICATED. K EQUALS THOUSANDS AND MEG EQUALS MILLIONS OF OHMS.

S-303 POSITIONS

1. CW	INT
2. PULSE	INT
3. POS.	EXT
4. NEG.	EXT
5. AM	EXT

Figure 7-3. Simplified Schematic of MOD SELECTOR Switch S-303





NOTES

ALL CAPACITOR VALUES IN MICRO-MICRO-FARADS, UNLESS OTHERWISE INDICATED

ALL RESISTANCE VALUES IN OHMS

K EQUALS THOUSANDS OF OHMS

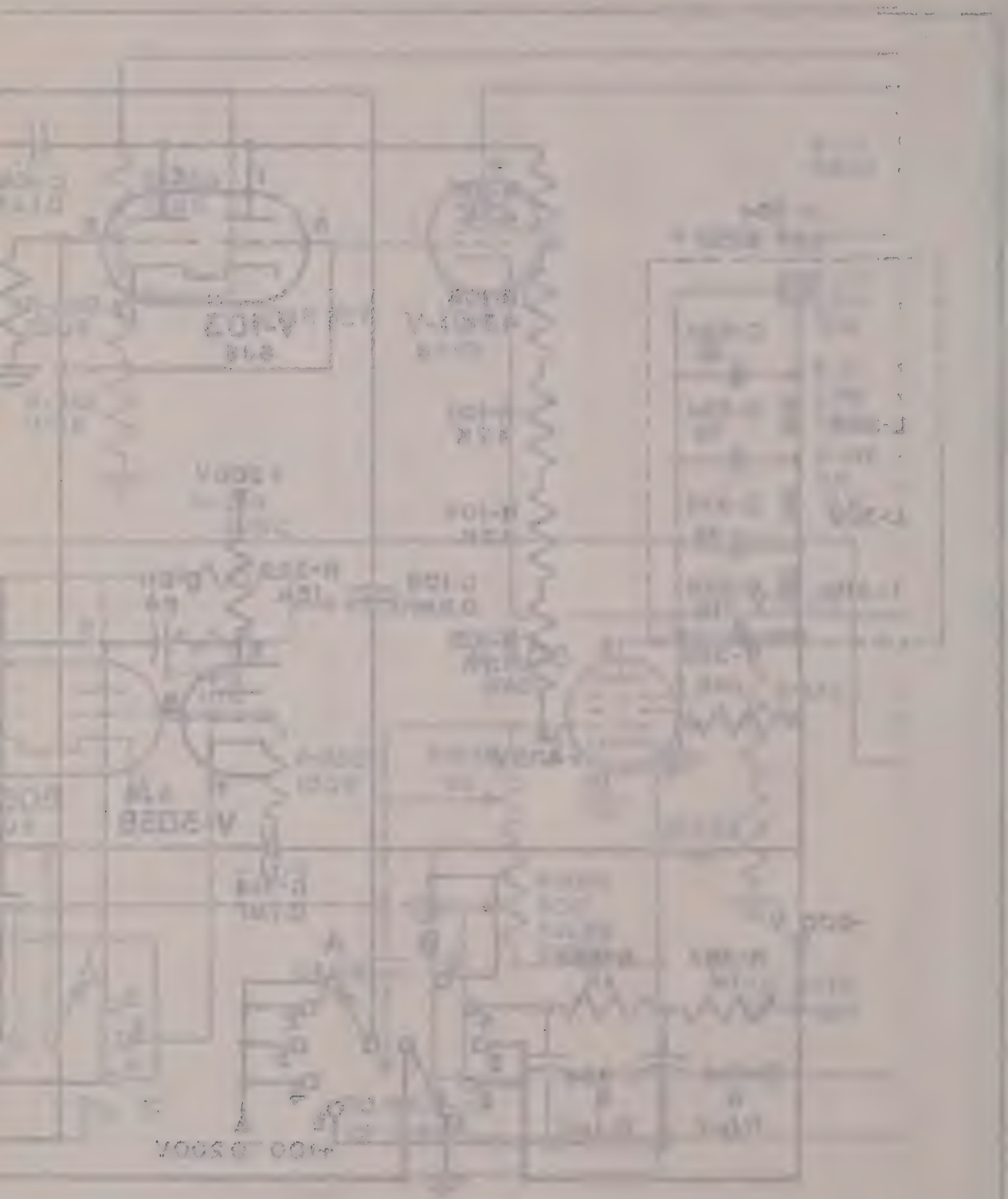
MEG EQUALS MILLIONS OF OHMS

MF EQUALS MICRO-FARADS

——— INDICATES FAR EDGE OF MOUNTING PANELS

——·—— INDICATES NEAR EDGE OF MOUNTING PANELS

The following items are not in TS-418/U: Cavity RF shield; Standoff insulators E-204, E-205; filters Z-203, Z-204, Z-205, Z-206, Z-302, Z-303, Z-304; terminal board E-320.



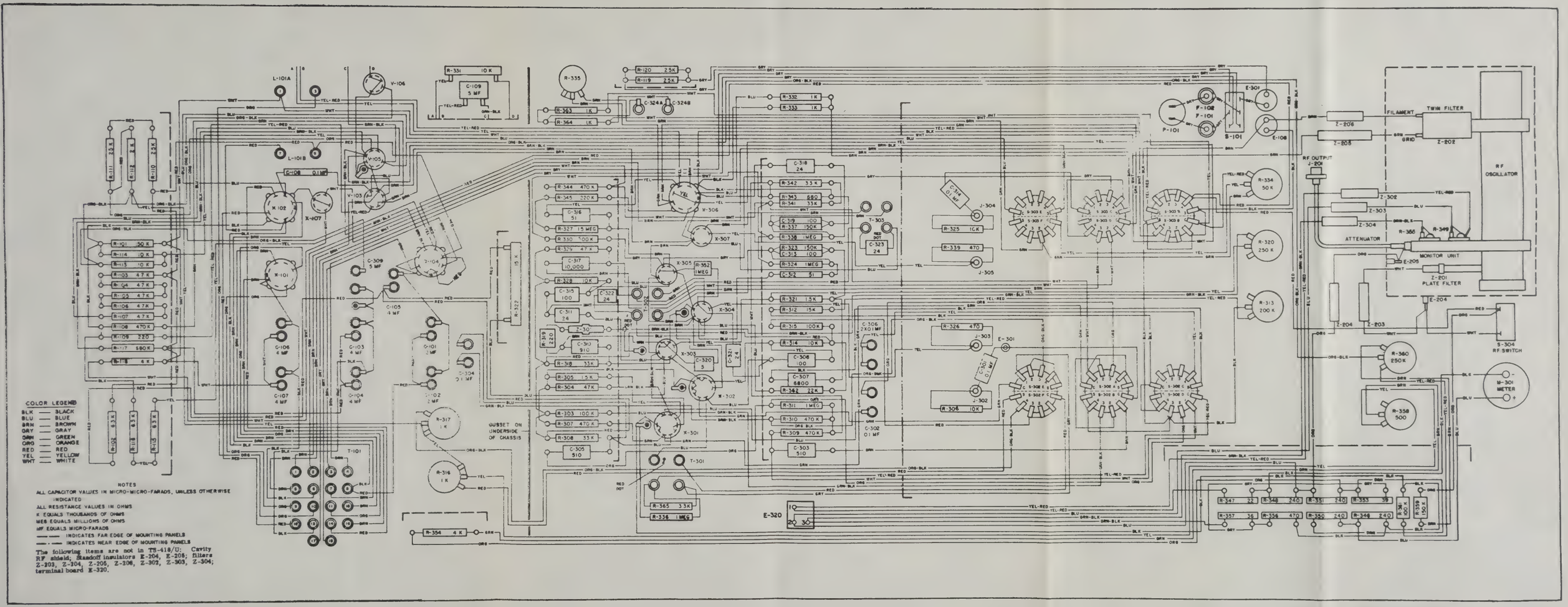
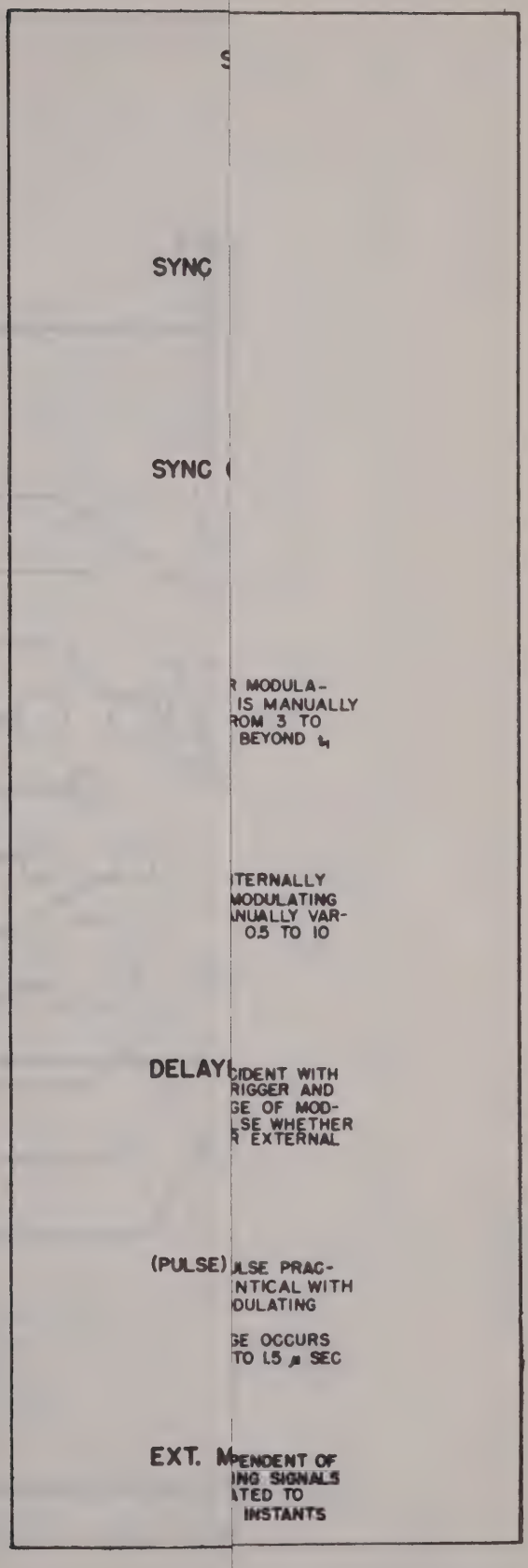


Figure 7-4. Signal Generator TS-418/U, Practical Wiring Diagram


SYNC
SYNC
R MODULA-
IS MANUALLY
ROM 3 TO
BEYOND 4
TERNALLY
MODULATING
NUALLY VAR-
0.5 TO 10
DELAY
CIDENT WITH
RIGGER AND
GE OF MOD-
LSE WHETHER
R EXTERNAL
(PULSE)
ULSE PRAG-
NTICAL WITH
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GE OCCURS
TO 1.5 μ SEC
EXT. M
PENDENT OF
ING SIGNALS
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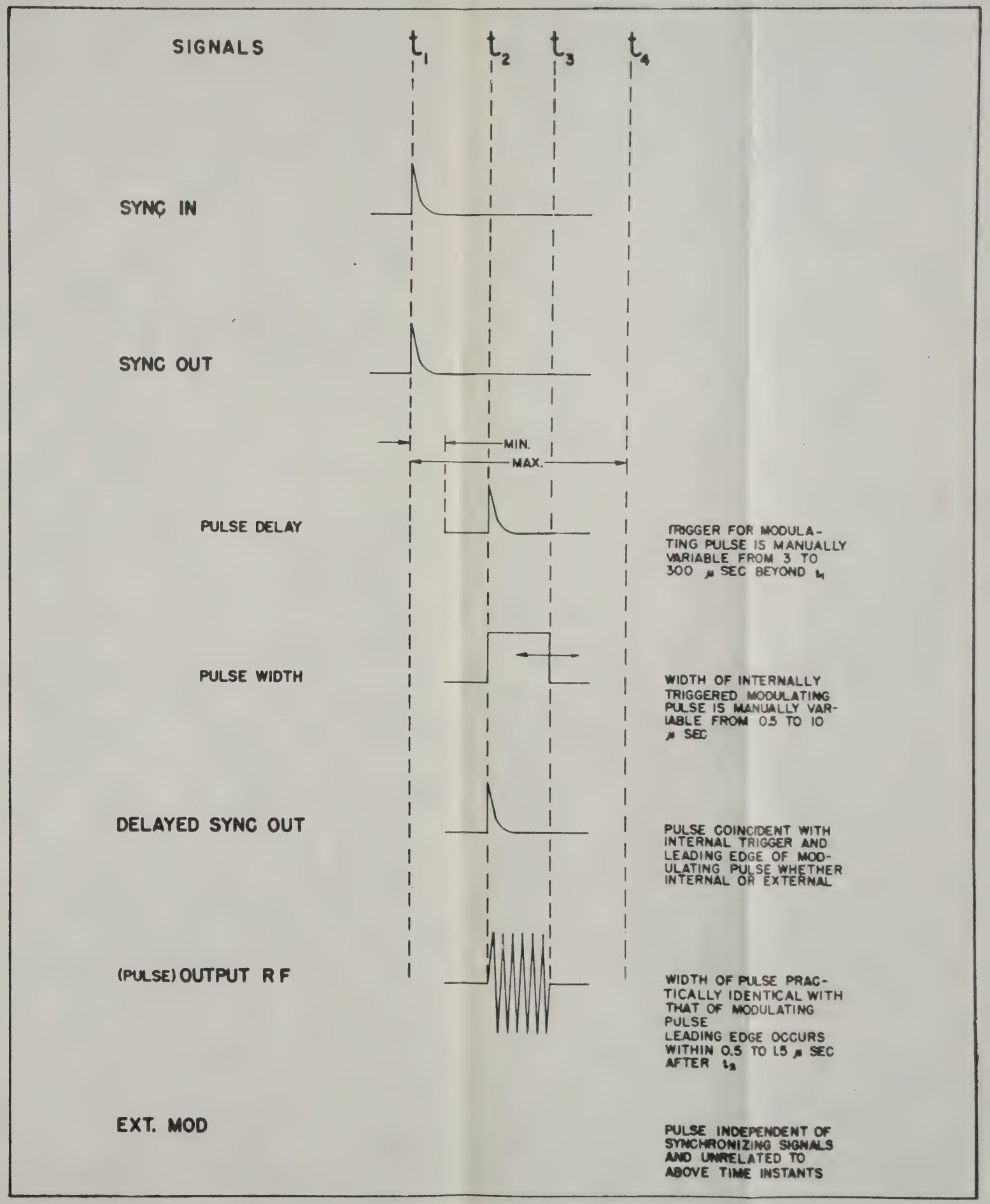
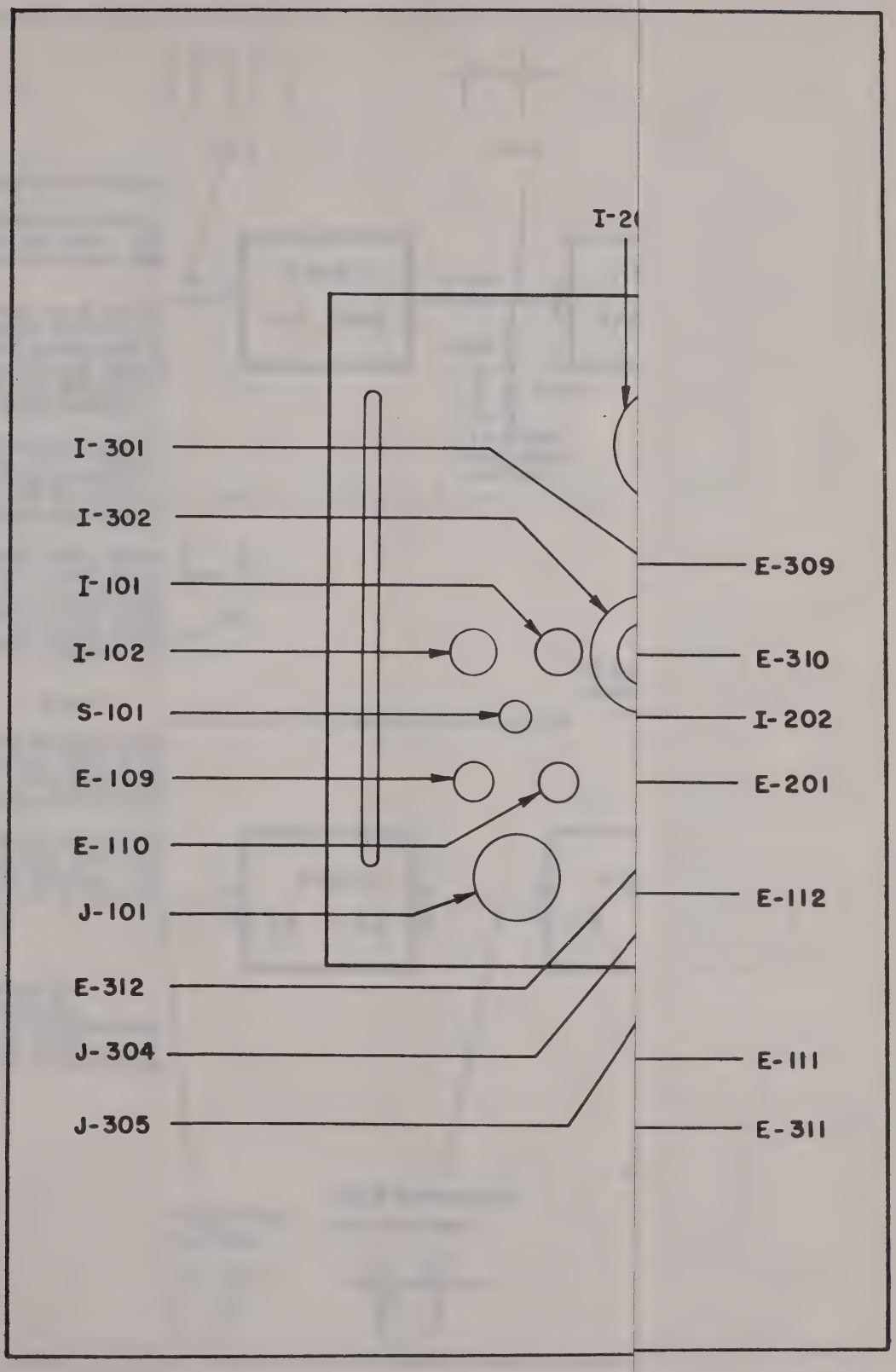


Figure 7-5. Timing Relations Diagram


I-2
I-301
I-302
I-101
I-102
S-101
E-109
E-110
J-101
E-312
J-304
J-305
E-309
E-310
I-202
E-201
E-112
E-111
E-311

ols

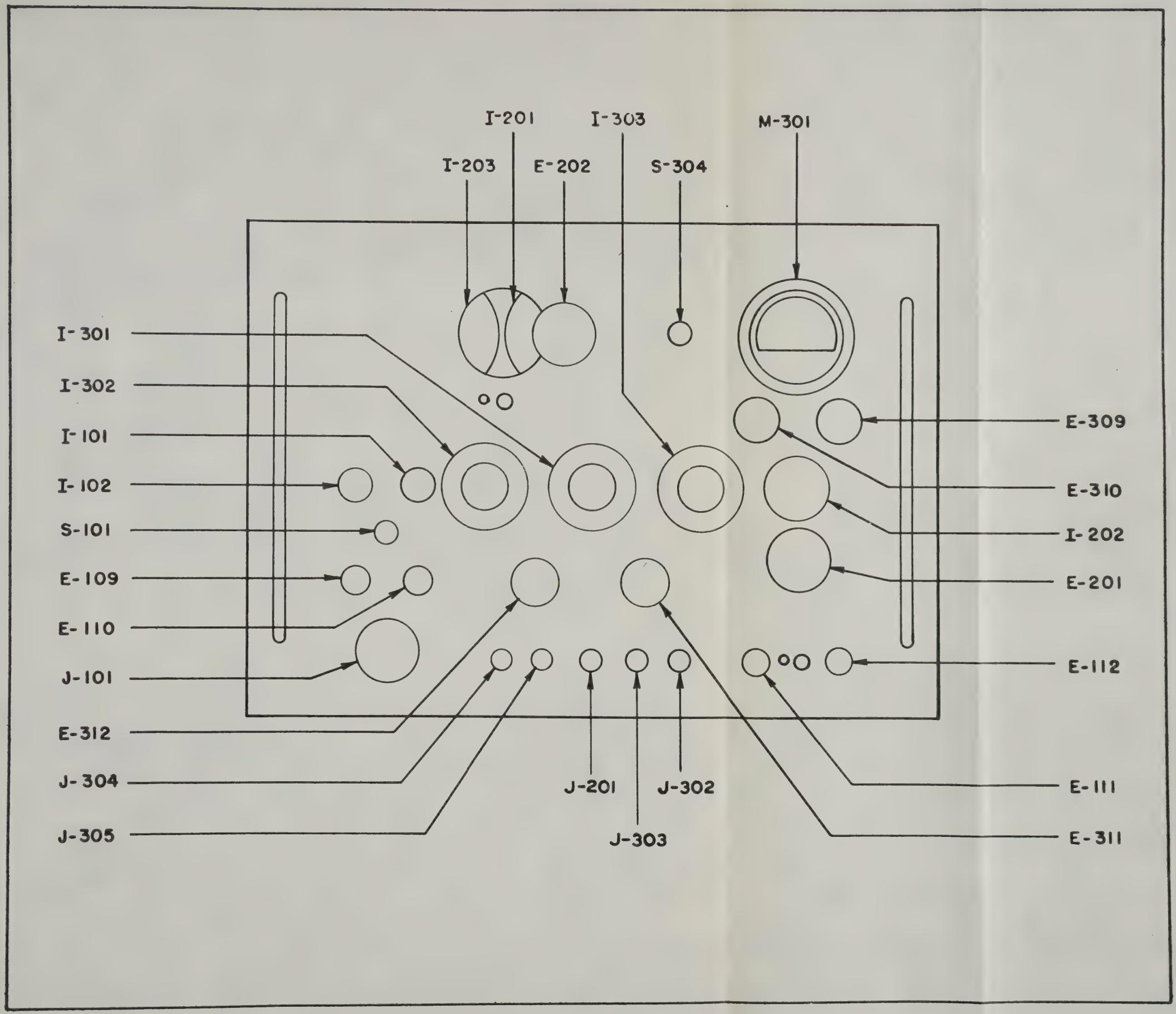
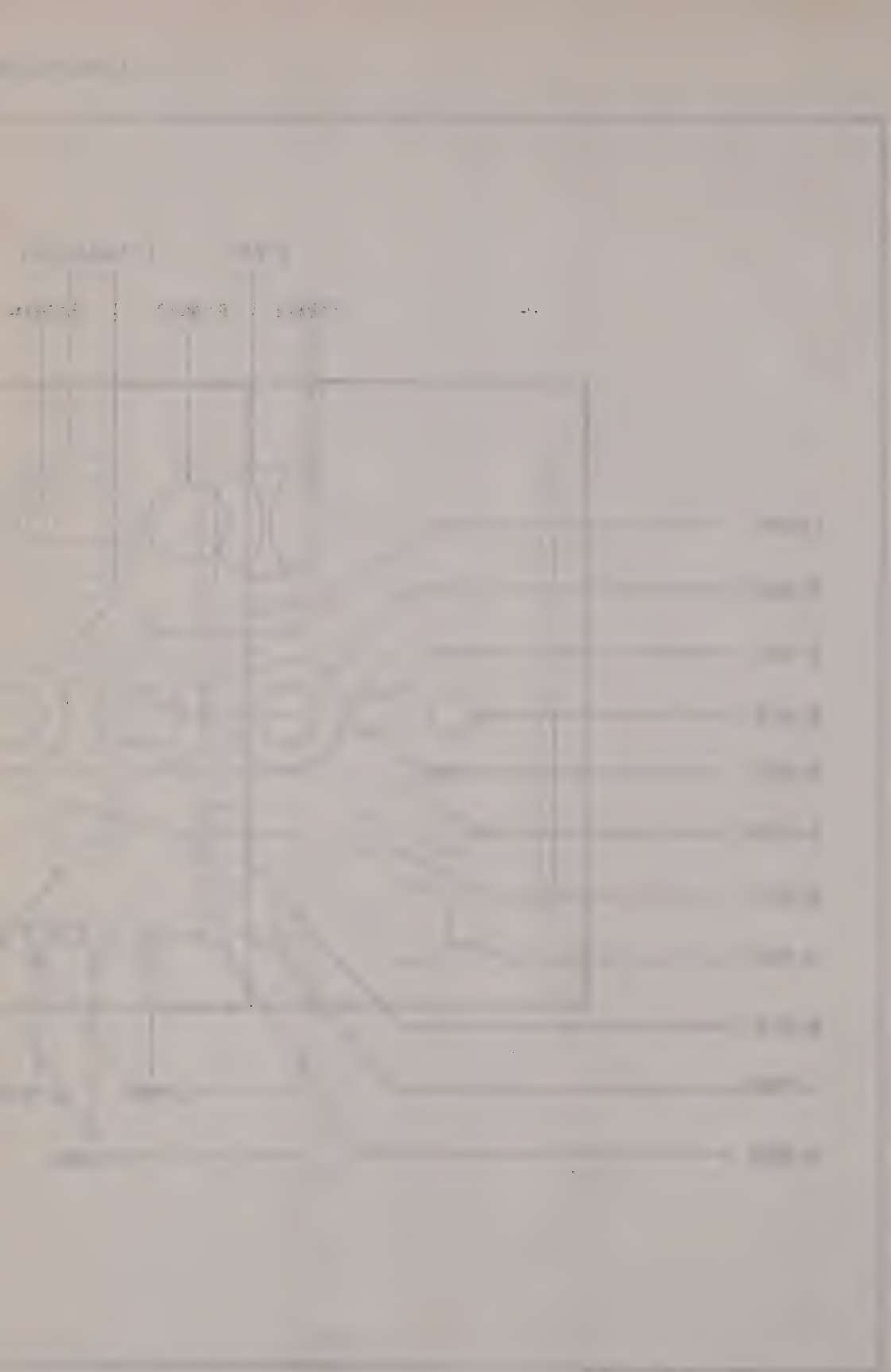


Figure 7-6. Signal Generator TS-418/U, Front Panel Controls



CONDITIONS OF MEASUREI

1. Waveshapes are shown on microsecond time base. SYN pulse was used to trigger osci sweep.

2. Waveshapes were obtaine Signal Generator TS-418/U chronized with an external 1(10-volt rms (28-volt peak-t sine wave (SYNC SELECTOR set to SINE WAVE position).

3. Pulse voltages shown are peak voltages. The voltages s regarded as approximations a vary at least 20% depending u of tubes, method of measurem

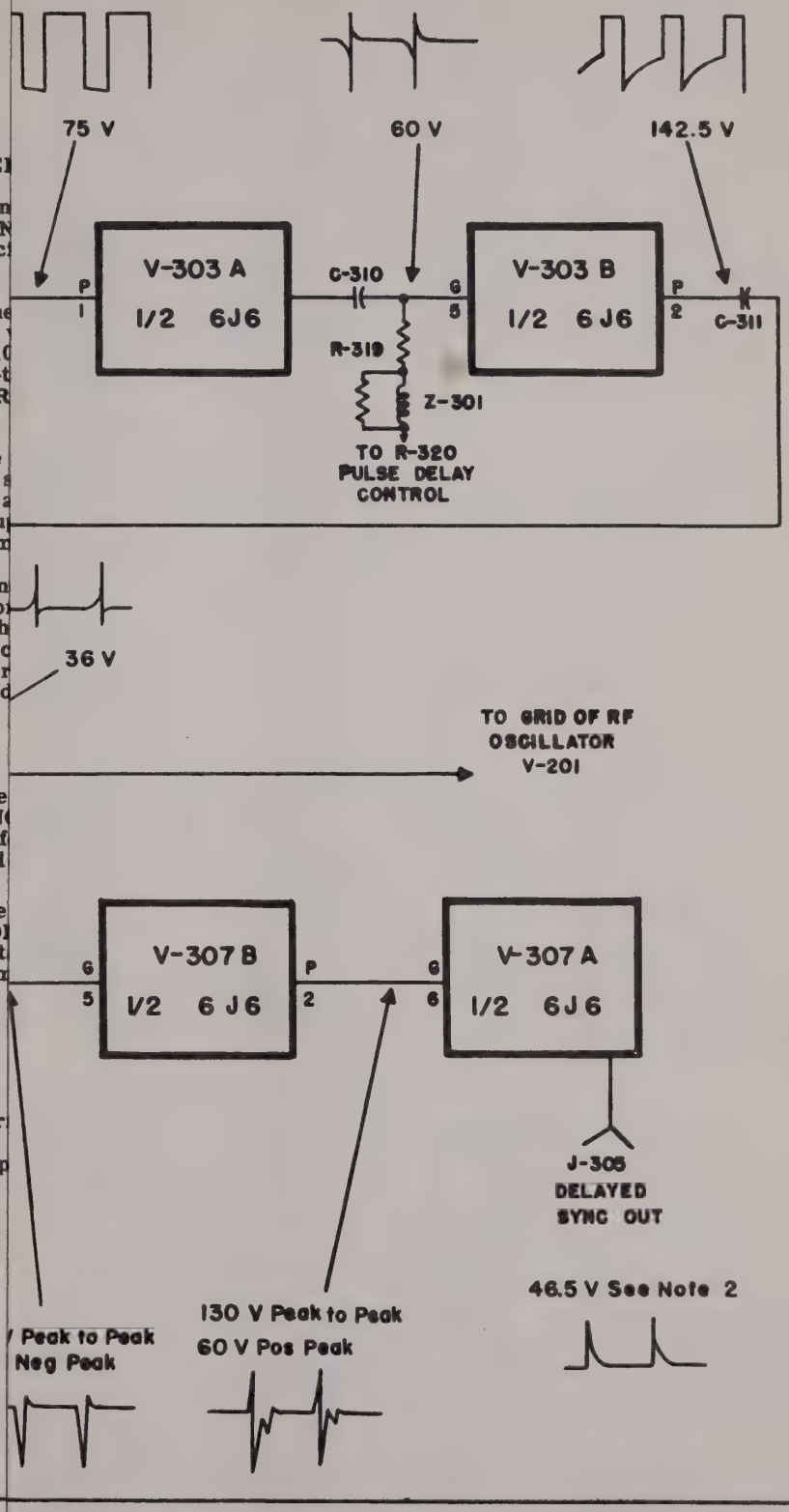
4. Waveshapes were obtain PULSE DELAY control set fo croseconds of delay and with WIDTH control set for 10 mic Waveshapes will vary accor pulse repetition frequency and controls.

NOTES

1. Amplitude of this voltage upon the load into which SYN working. Voltage given is f load of 500 ohms shunted by 1

2. Amplitude of this voltage upon the load into which DI SYNC OUT is working. Volt is for rated load of 500 ohm by 1500 mmf.

Note:
S-302 in position (3)
S-303 in position (2)
J-303 and J-305 without exter
Pulse width set to Min
Readings taken on Oscilloscop



7-7. Signal Generator TS-418/U, Servicing Block Diagram

AN 16-35TS418-3

CONDITIONS OF MEASUREMENT

1. Waveshapes are shown on a 2500-microsecond time base. SYNC OUT pulse was used to trigger oscilloscope sweep.

2. Waveshapes were obtained when Signal Generator TS-418/U was synchronized with an external 1000 cps, 10-volt rms (28-volt peak-to-peak) sine wave (SYNC SELECTOR switch set to SINE WAVE position).

3. Pulse voltages shown are peak-to-peak voltages. The voltages should be regarded as approximations and may vary at least 20% depending upon age of tubes, method of measurement, etc.

4. Waveshapes were obtained with PULSE DELAY control set for 100 microseconds of delay and with PULSE WIDTH control set for 10 microseconds. Waveshapes will vary according to pulse repetition frequency and setting of controls.

NOTES

1. Amplitude of this voltage depends upon the load into which SYNC OUT is working. Voltage given is for rated load of 500 ohms shunted by 1500 mmf.

2. Amplitude of this voltage depends upon the load into which DELAYED SYNC OUT is working. Voltage given is for rated load of 500 ohms shunted by 1500 mmf.

Note:
S-302 in position (3)
S-303 in position (2)
J-303 and J-305 without external load
Pulse width set to Min
Readings taken on Oscilloscope TS-239/U

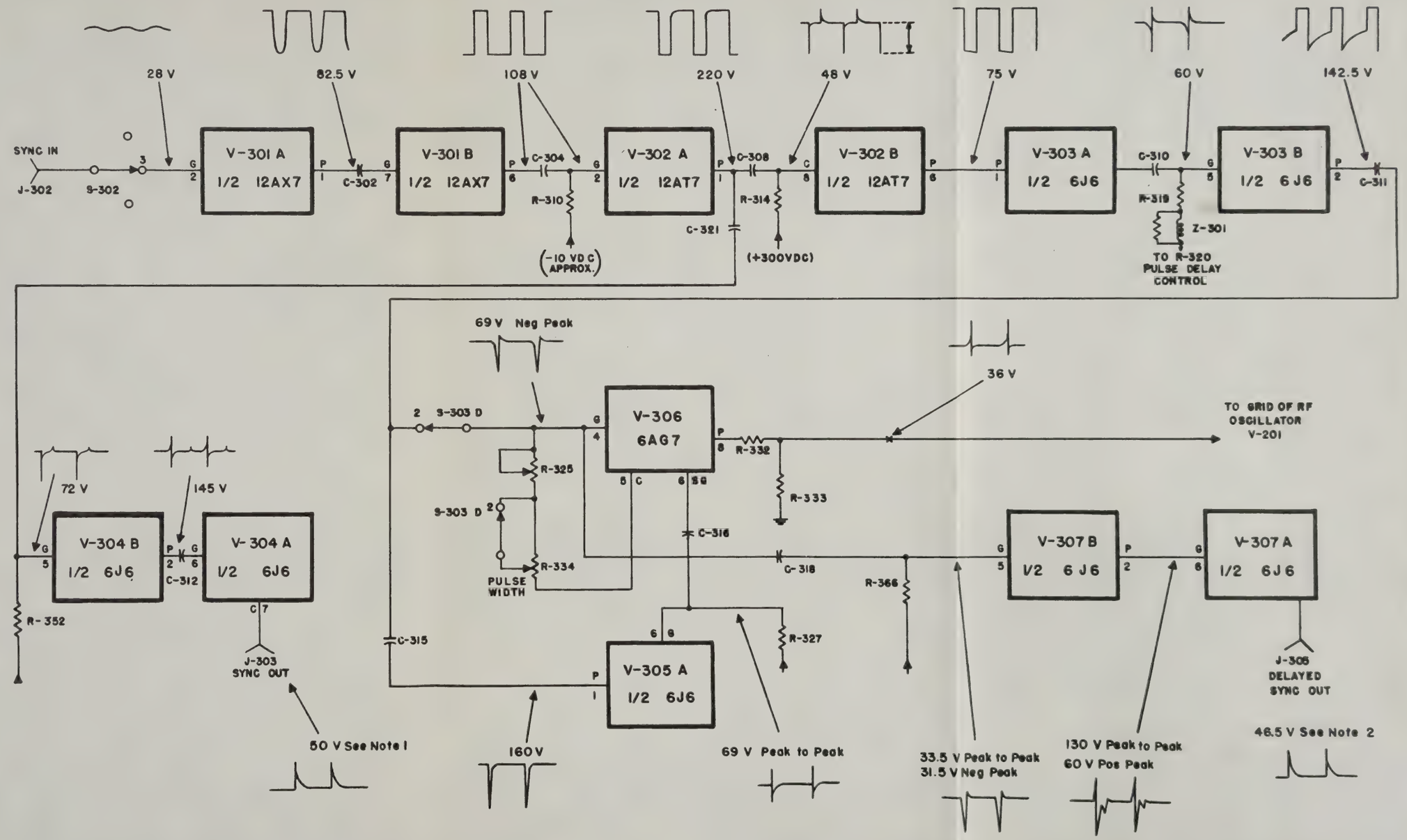
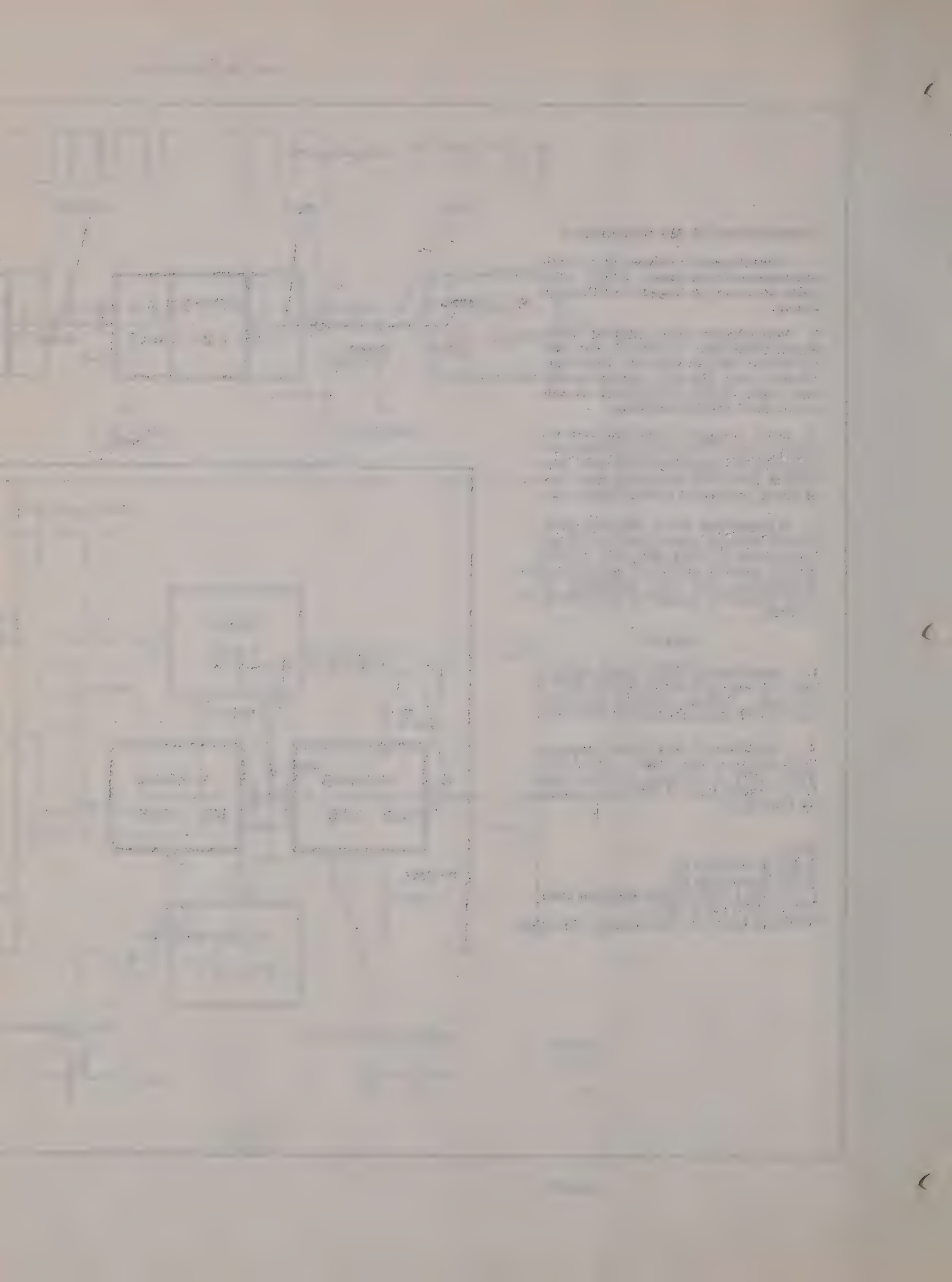


Figure 7-7. Signal Generator TS-418/U, Servicing Block Diagram



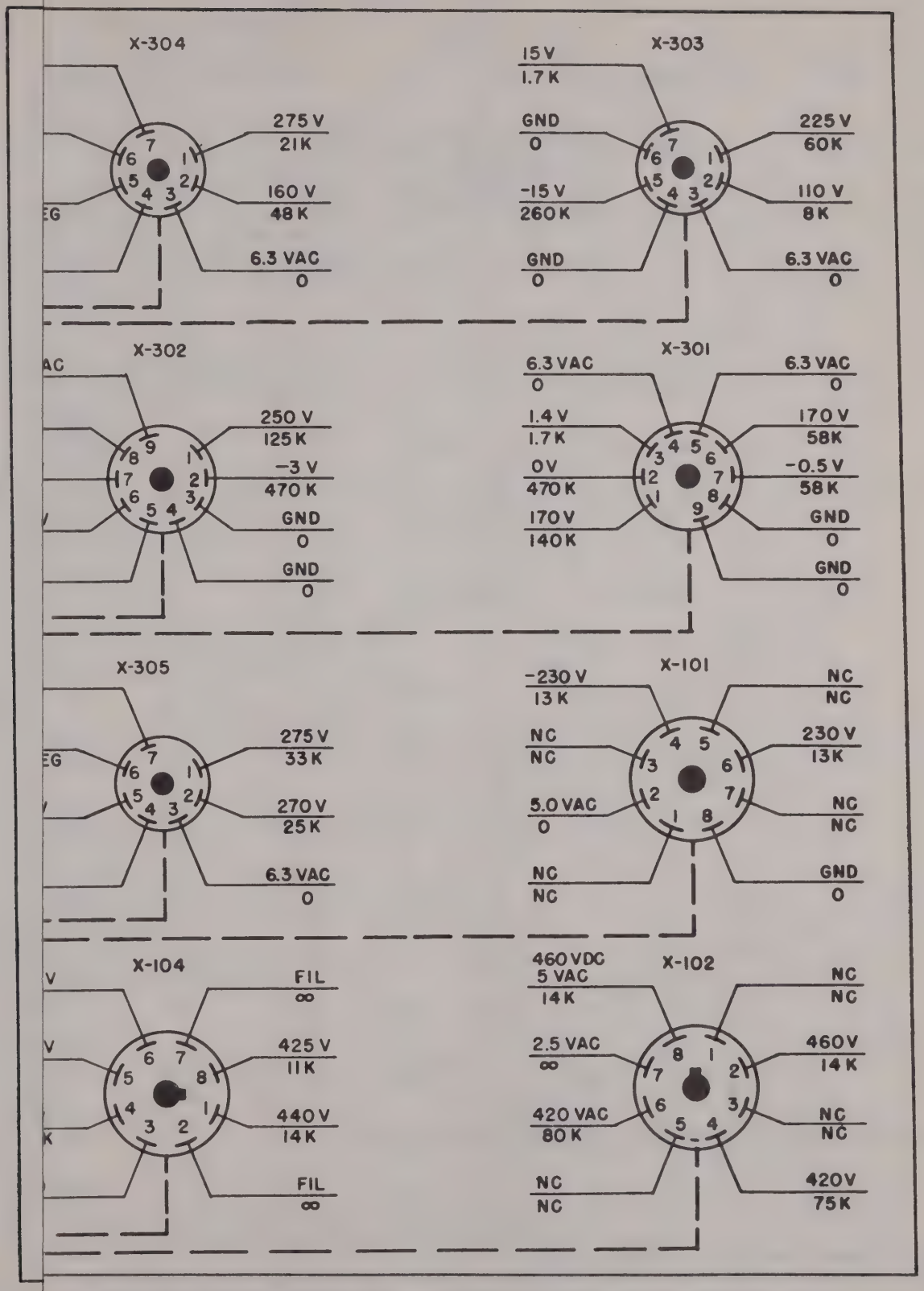


Figure 7-8. Signal Generator TS-418/U, Voltage and Resistance Measurements

CONDITIONS OF MEASUREMENT

1. All readings were taken with a 20,000 ohm per volt Simpson Model 260 multimeter.
2. Voltages were measured from the pins shown to (Chassis) ground.
3. Resistances were measured to (chassis) ground from pin shown.
4. Voltages and resistances were measured with SYNC SELECTOR switch set to SINE and MOD SELECTOR switch set to PULSE. No synchronizing voltage was applied.

NOTES

1. All filament readings were 6.4 V AC as measured between terminals (No V AC to GND).
2. X-102 - Pin 7 voltage measured to pin 2.
3. X-302 - Pin 2 - PULSE RATE not in circuit on SINE position.
4. X-306 - Pin 4 - to 55 K ohms on maximum PULSE WIDTH.
5. X-303 - Pin 5 - to 250 K on MAX PULSE DELAY.
6. X-305 - Pin 5 - Bias Circuit.
7. Grid lead to oscillator at junction of R-332 and R-333 measured 37.8 VDC; 970 ohms.
8. Plate lead at end of plate filter VDC = 146; R = 11.8K.
9. PULSE RATE - No effect on voltage.
10. PULSE DELAY - No effect on voltage except for pin 5, V-305. Reading on this pin was with PULSE DELAY on MIN.
11. PULSE WIDTH - Decreases voltage approx. 3V per 100V.

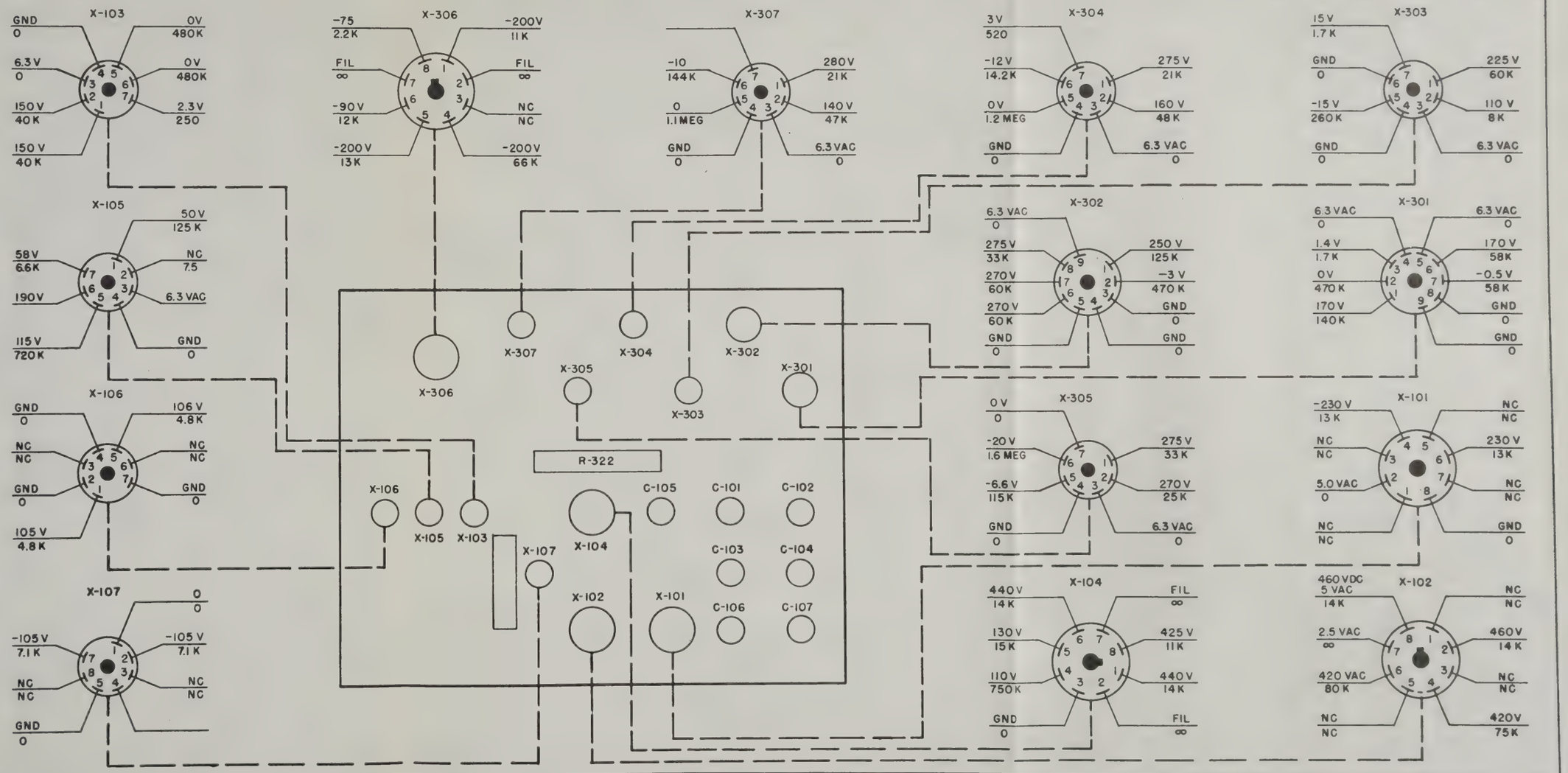
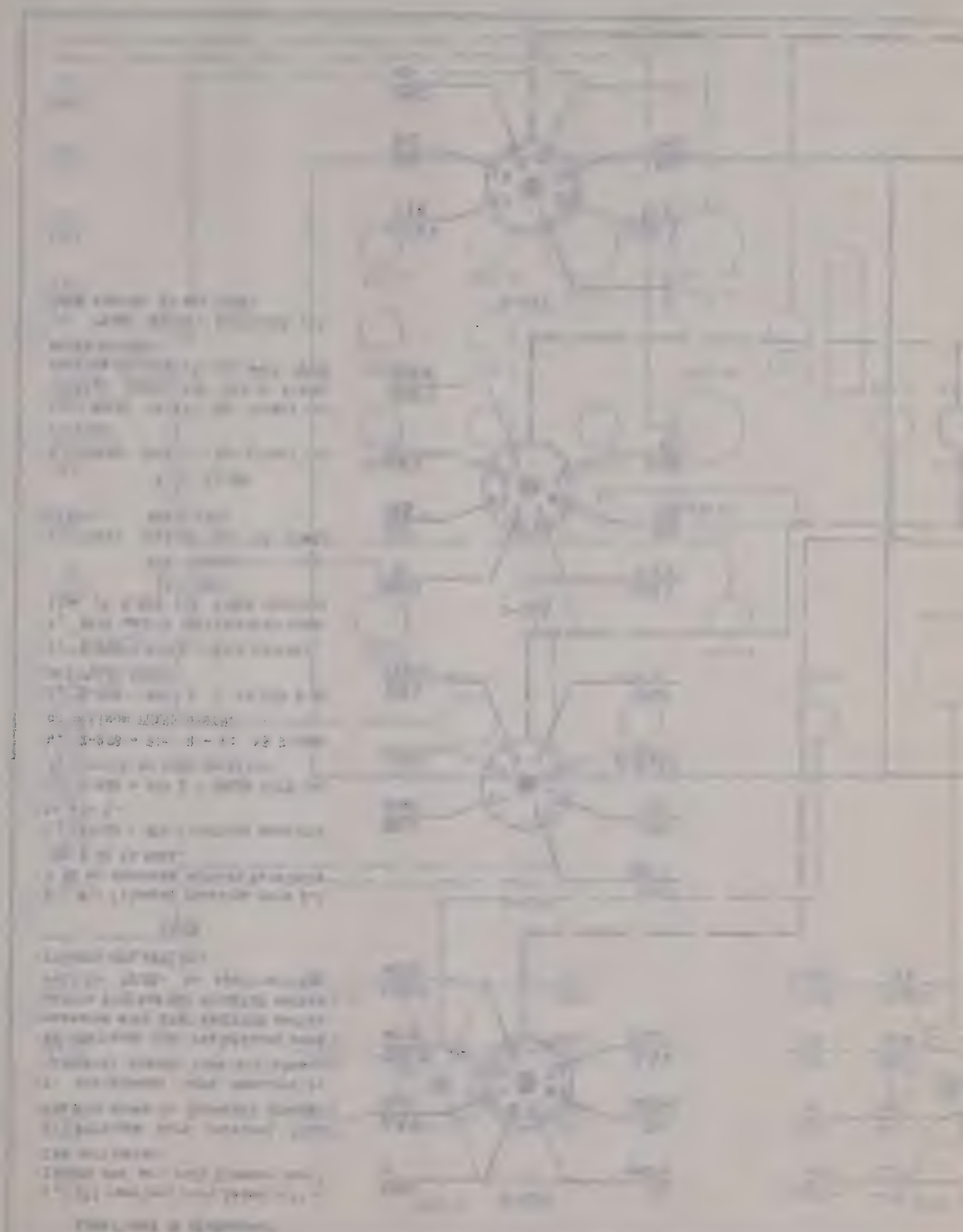


Figure 7-8. Signal Generator TS-418/U, Voltage and Resistance Measurements



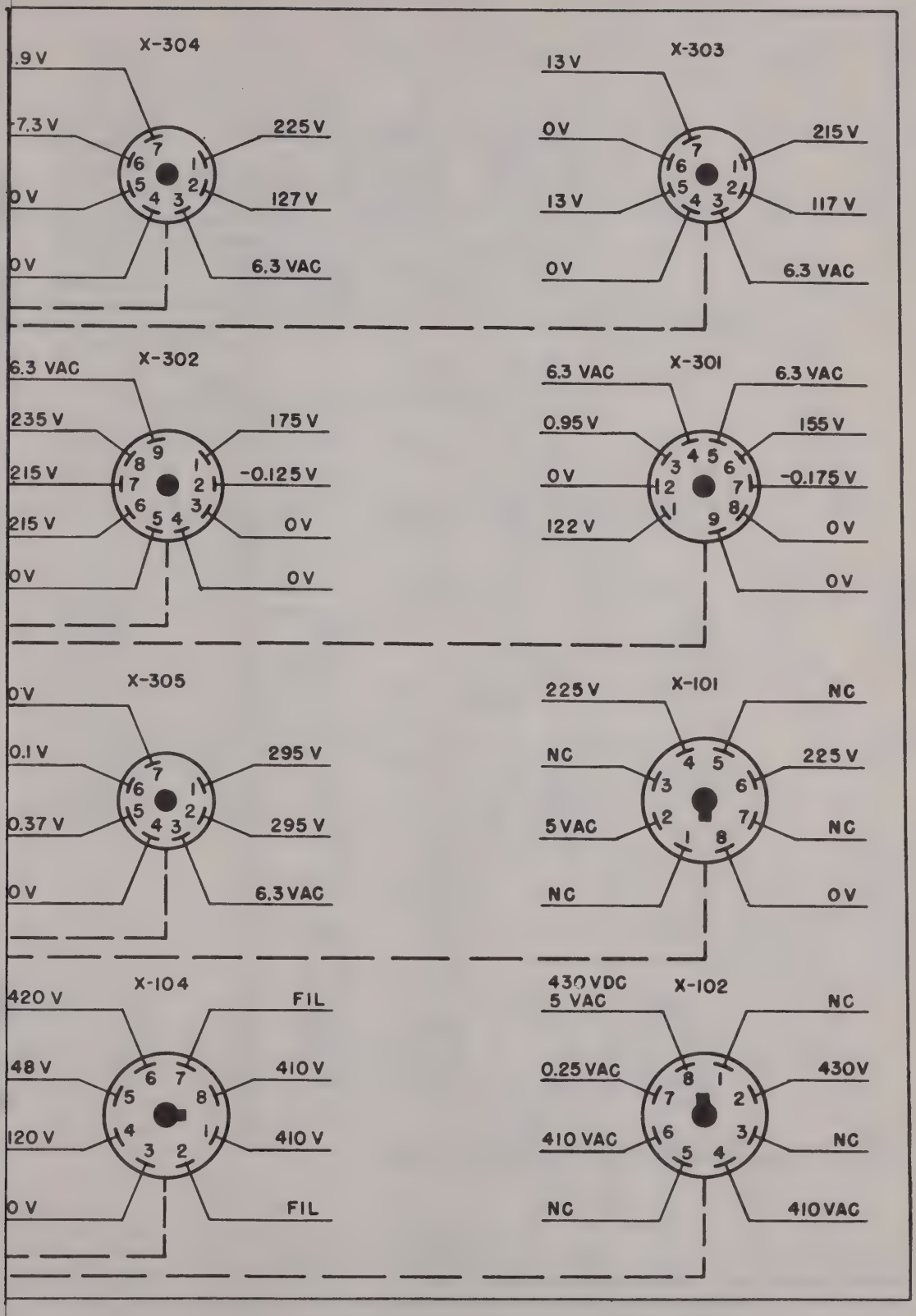


Figure 7-9. Signal Generator TS-418/U, Voltage Measurements

CONDITIONS OF MEASUREMENT

1. All readings were taken with a 1,000 ohm per volt Simpson Model 443 multimeter.
2. Voltages were measured from the pins shown to (Chassis) ground.
3. Resistances were measured to (Chassis) ground from pin shown.
4. Voltages and resistances were measured with SYNC SELECTOR switch set to SINE and MOD SSELECTOR switch set to PULSE. No synchronizing voltage was applied.

NOTES

1. All filament readings were 6.4 VAC between terminals (No VAC to GND).
2. X-102 - Pin 7 - Voltage was measured to Pin 2.
3. X-302 - Pin 2 PULSE RATE not in circuit on SINE position.
4. X-303 - Pin 5 Bias Circuit.
5. Grid lead to oscillator at junction of R-332 and R-333 was -37.8 VDC.
6. Plate lead at end of plate filter measured 148 VDC.
7. PULSE RATE) No effect on voltage.
8. PULSE DELAY) No effect on voltage except for pin 5, V-303.
9. PULSE WIDTH - Decreases voltage approx. 3 V per 100 V.

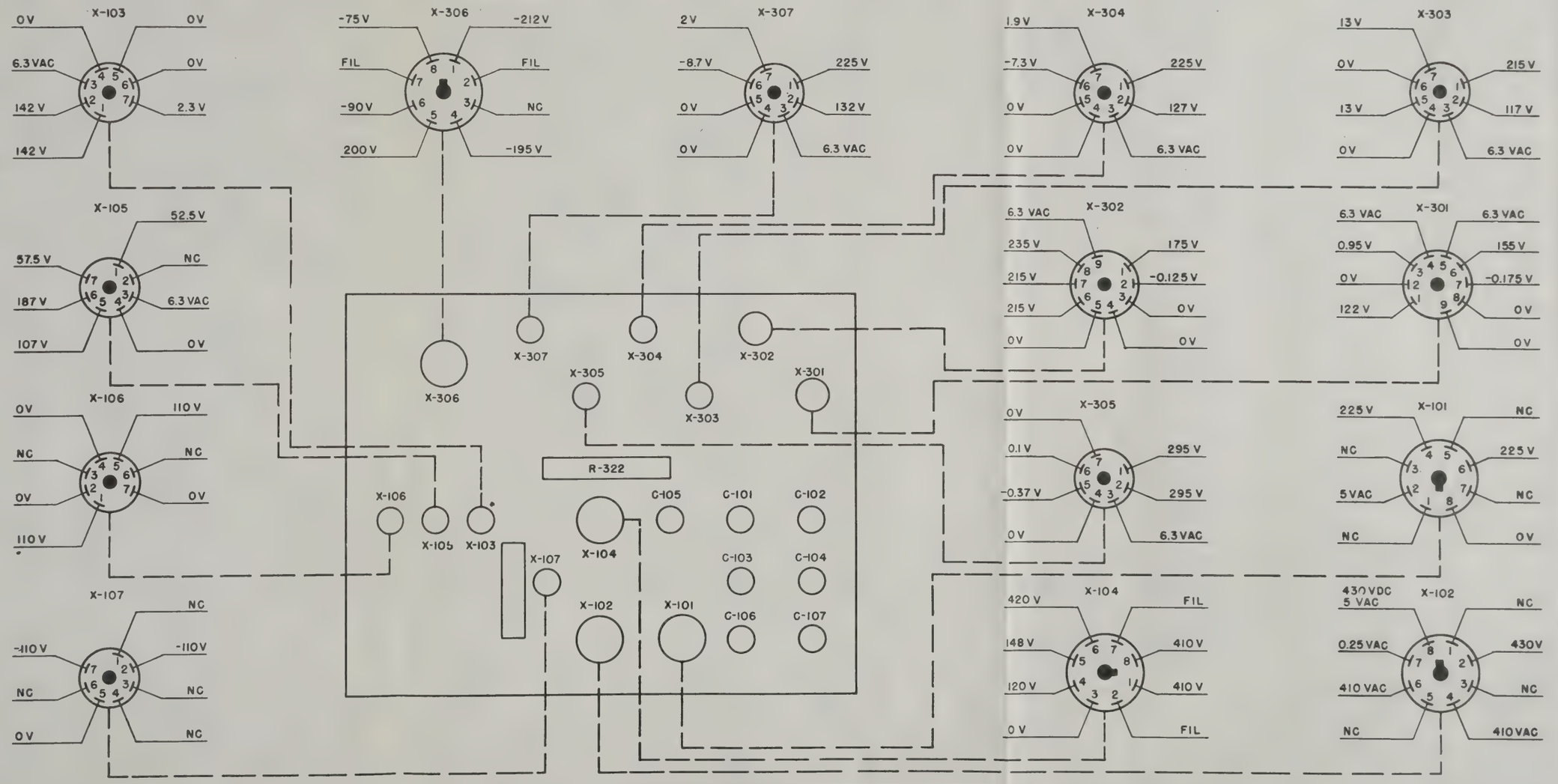
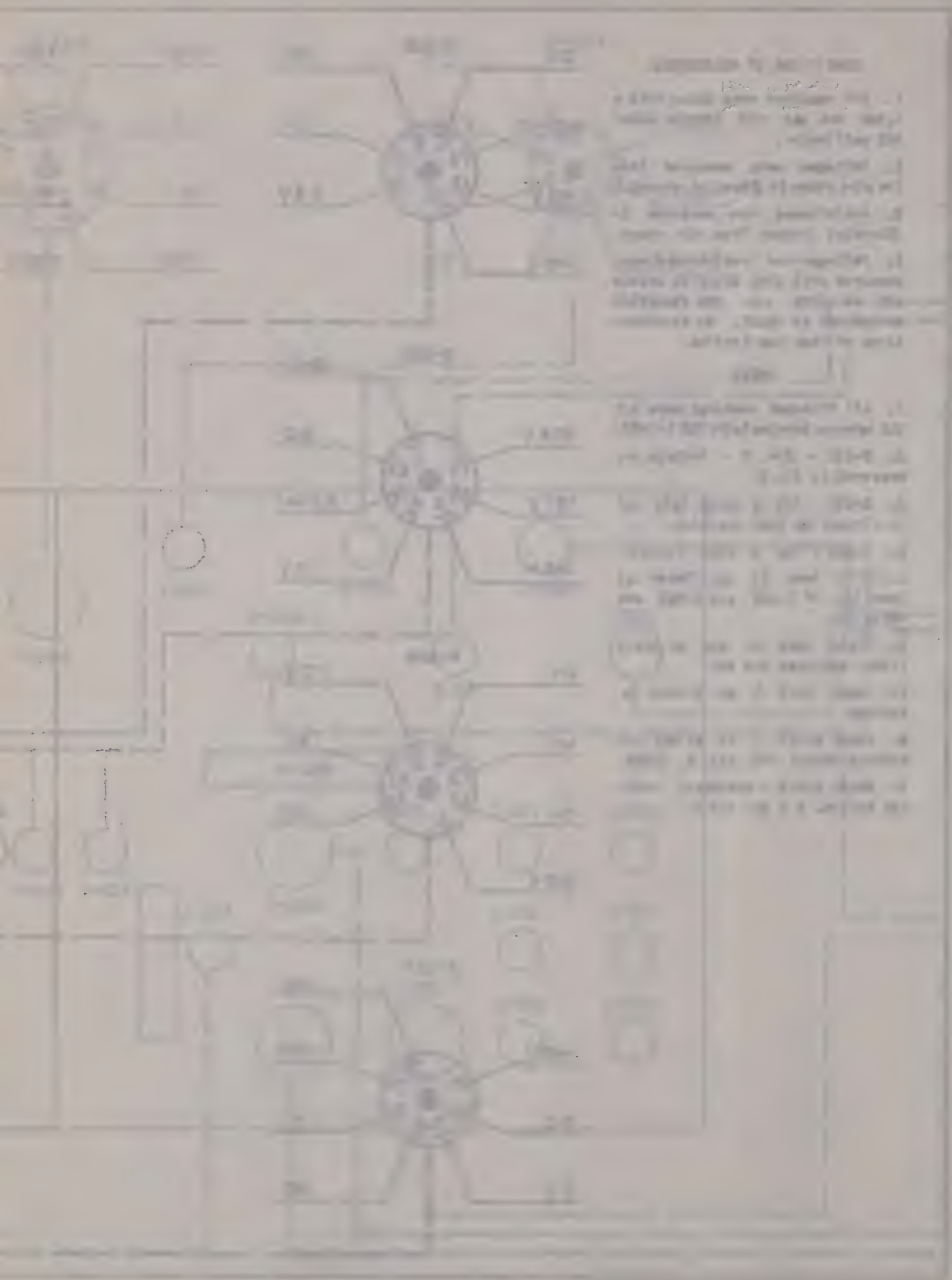


Figure 7-9. Signal Generator TS-418/U, Voltage Measurements



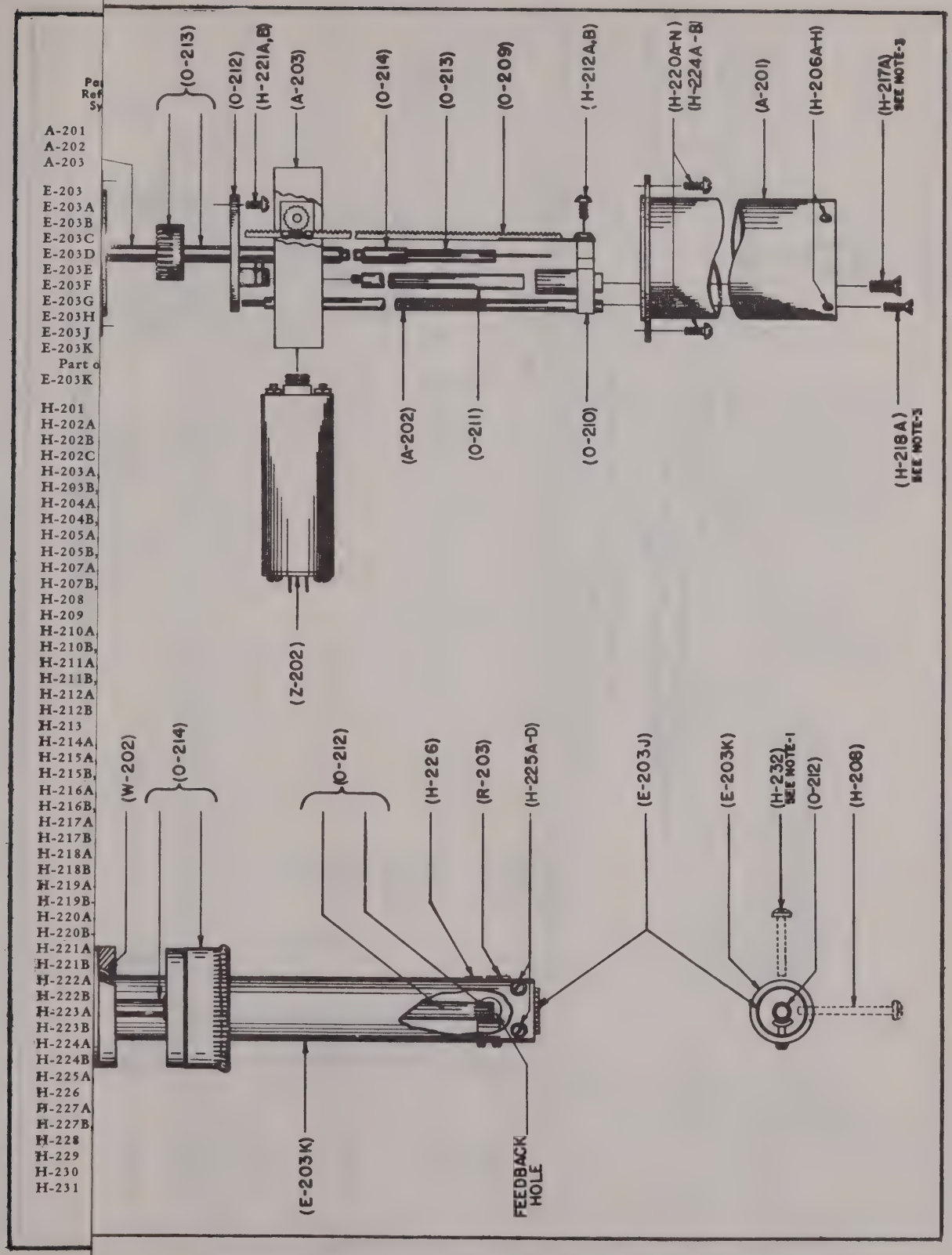


Figure 7-10. Exploded View and Sectional Cutaway View RF Oscillator

AN 16-35TS418-3

Parts List Reference Symbol	Name	Cross Reference to Section IV Figure Nos.
A-201	Housing, cavity end	4-14; 4-15
A-202	Rail, carriage guide	4-19
A-203	Block, cavity support	4-14; 4-15
E-203	Cavity, tuned	4-24; 4-25
E-203A	Probe, RF (attenuator unit)	4-11; 4-18
E-203B	Probe, RF (monitor unit)	4-11; 4-18
E-203C	Insulator, plate (mica)	4-17; 4-26
E-203D	Insulator, standoff	4-13; 4-17
E-203E	Insulator, standoff	4-13; 4-17
E-203F	Bracket, filter support	4-27
E-203G	Insulator, disk (teflon)	4-17; 4-18
E-203H	Insulator, disc (mica)	4-18
E-203J	Brush, grid contact	4-23
E-203K	Body, cylinder grid	4-16
Part of E-203K	Retainer, grid cylinder	4-19; 4-20
H-201	Grommet	4-27
H-202A	Stud, tube retainer	4-2; 4-27
H-202B	Washer, lock	4-2
H-202C	Stud, tube retainer	4-2; 4-27
H-203A, C, E, G	Screws	4-17
H-203B, D, F, H	Washers, lock	4-17
H-204A, C	Screws	4-14; 4-15
H-204B, D	Washers, lock	4-14; 4-15
H-205A, C, E, G	Screws	4-17
H-205B, D, F, H	Washers, lock	4-17
H-207A, C, E, G	Screws	4-19
H-207B, D, F, H	Washers, lock	4-19
H-208	Screw, tuning	4-7; 4-8
H-209	Nut	4-7
H-210A, C	Screws	4-27
H-210B, D	Washers, lock	4-27
H-211A, C	Screws	4-27
H-211B, D	Washers, lock	4-27
H-212A	Screw	4-19
H-212B	Washer, lock	4-19
H-213	Screw, adjustment	4-13; 4-17
H-214A, B, C, D	Screws	4-17; 4-18
H-215A, C	Screws	4-14; 4-15
H-215B, D	Washers, lock	4-14; 4-15
H-216A, C	Screws	4-14; 4-15
H-216B, D	Washers, lock	4-14; 4-15
H-217A	Screw	4-15
H-217B	Washer, lock	4-15
H-218A	Screw	4-15
H-218B	Washer, lock	4-15
H-219A-M	Screws	4-16
H-219B-N	Washers, lock	4-16
H-220A-M	Screws	4-13
H-220B-N	Washers, lock	4-13
H-221A	Screw	4-20
H-221B	Washer, lock	4-20
H-222A	Screw	4-20
H-222B	Washer, lock	4-20
H-223A	Screw	4-16
H-223B	Washer, lock	4-16
H-224A	Screw	4-15
H-224B	Washer, lock	4-15
H-225A, B, C, D	Screws	4-23
H-226	Grommet, phenolic	4-23
H-227A, C	Screws	4-21
H-227B, D	Washers, lock	4-21
H-228	Washer, flat	4-21
H-229	Screw (for item 103)	4-8; 4-25
H-230	Screw (for O-216)	4-8; 4-25
H-231	Screw (for O-224)	4-11; 4-25

Parts List Reference Symbol	Name	Cross Reference to Section IV Figure Nos.
I-201	Dial, (vernier) frequency-indicating	4-3; 4-6
I-202	Dial, attenuator	4-6; 4-11
I-203	Gear (anti-backlash) Dial, including hub	
	Shaft (for Gear and Dial)	4-3; 4-6
L-212	Suppressor Lead	4-20
O-201	Cap, cavity end	4-1; 4-2
O-202	Gasket, cavity cap	4-10; 4-27
O-203	Retainer, tube	4-2; 4-18
O-204A, B, C, D	Bushing, phenolic	4-16; 4-17
O-205	Guide, shaft (for attenuator)	4-11; 4-13
O-206	Retainer, tube	4-18
O-207	Spring	4-14; 4-15
O-208	Arm, dial stop (with set screw) -208 in end to lock dial stop pin)	4-14; 4-15
O-209	Gear, axial drive rack	4-19
O-210	Block, carriage guide	4-19; 4-22
O-211	Shaft, cavity carriage	4-19
Part of O-212	Guide, carriage support	4-20; 4-22
Part of O-212	Body, Cathode cylinder	4-20; 4-22
Part of O-213	Push rods, grid cylinder brush	4-19
Part of O-213	Brush, grid cylinder	4-20
Part of O-214	Brush, plate cylinder	4-16
Part of O-214	Push rods, plate cylinder brush	4-16; 4-19
O-215	Cam, dial stop	4-25; 4-28
O-216	Cam, dial stop	4-25; 4-28
O-217	Gear with shaft	4-8; 4-9
O-218	Gear, dial drive	4-6; 4-9
O-219	Gear, dial drive (anti-backlash)	4-6; 4-8
O-220	Gear, cavity drive pinion with shaft	4-19; 4-21
O-221	Spring, carriage drive guide	4-21
O-222	Plate, spacer	4-21
O-223	Bearing, sleeve	4-21
O-224	Cam, attenuator stop	4-11; 4-25
O-225	Shaft and Gear, attenuator drive	4-6; 4-11
R-201	Resistor, plate filter	4-2; 4-27
R-203	Resistor, grid	4-23
R-204	Resistor, thermal (bead thermistor)	5-6
R-349	Resistor, thermal (disc thermistor)	4-17; 4-26
R-355	Resistor, thermal (disc thermistor)	4-17; 4-26
V-201	Electron tube (2C36)	4-1; 4-2
W-203	Filament lead	4-22
Z-201	Filter, low pass (plate)	4-10; 4-11
Z-202	Filter, low pass (twin unit)	4-14; 4-19
	Arm, dial stop (with set screw O-208 in end to lock dial stop pin)	4-14; 4-15
	Lug, negative terminal	4-17; 4-26
	Screws, set (3)	4-21

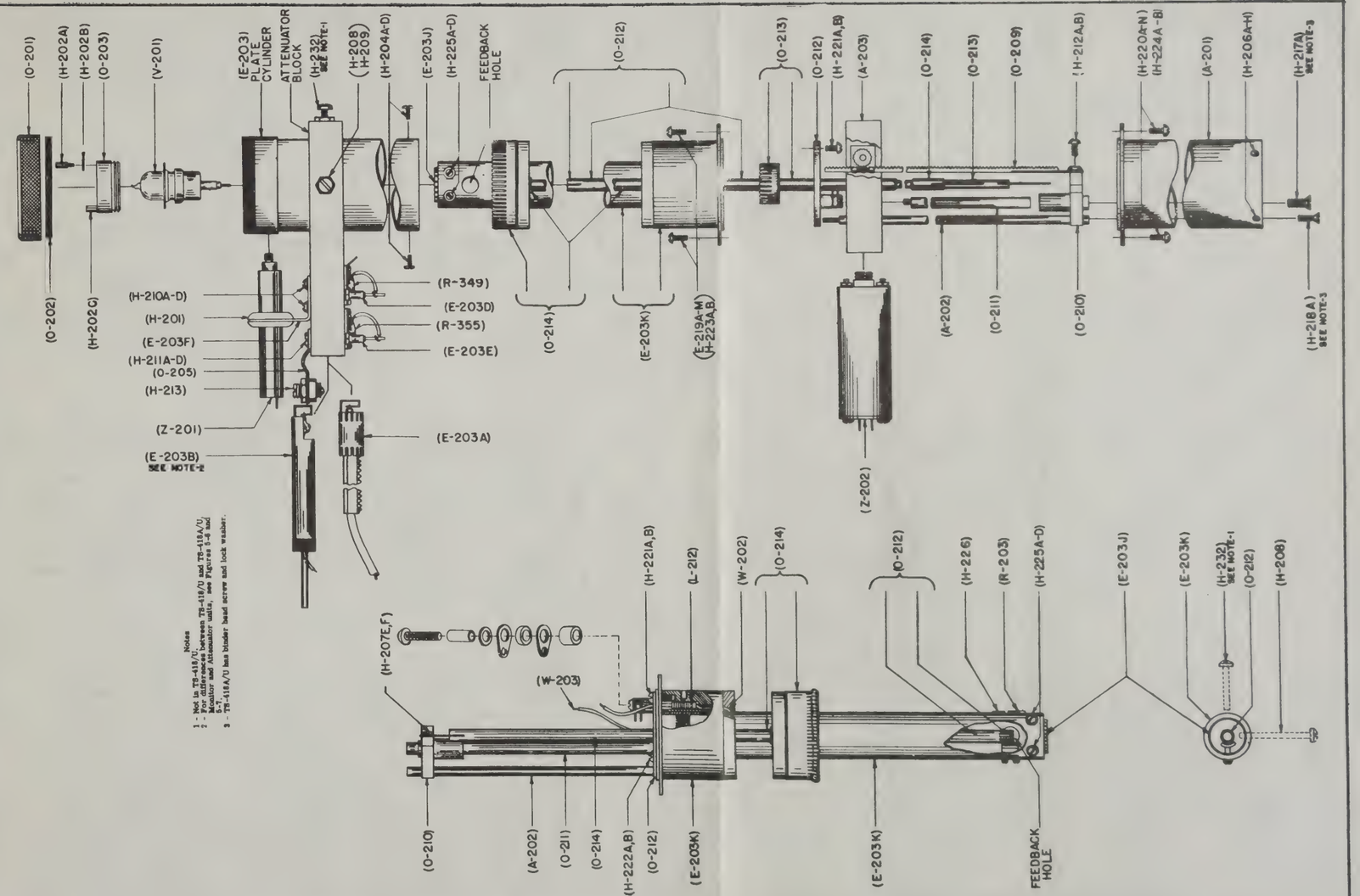
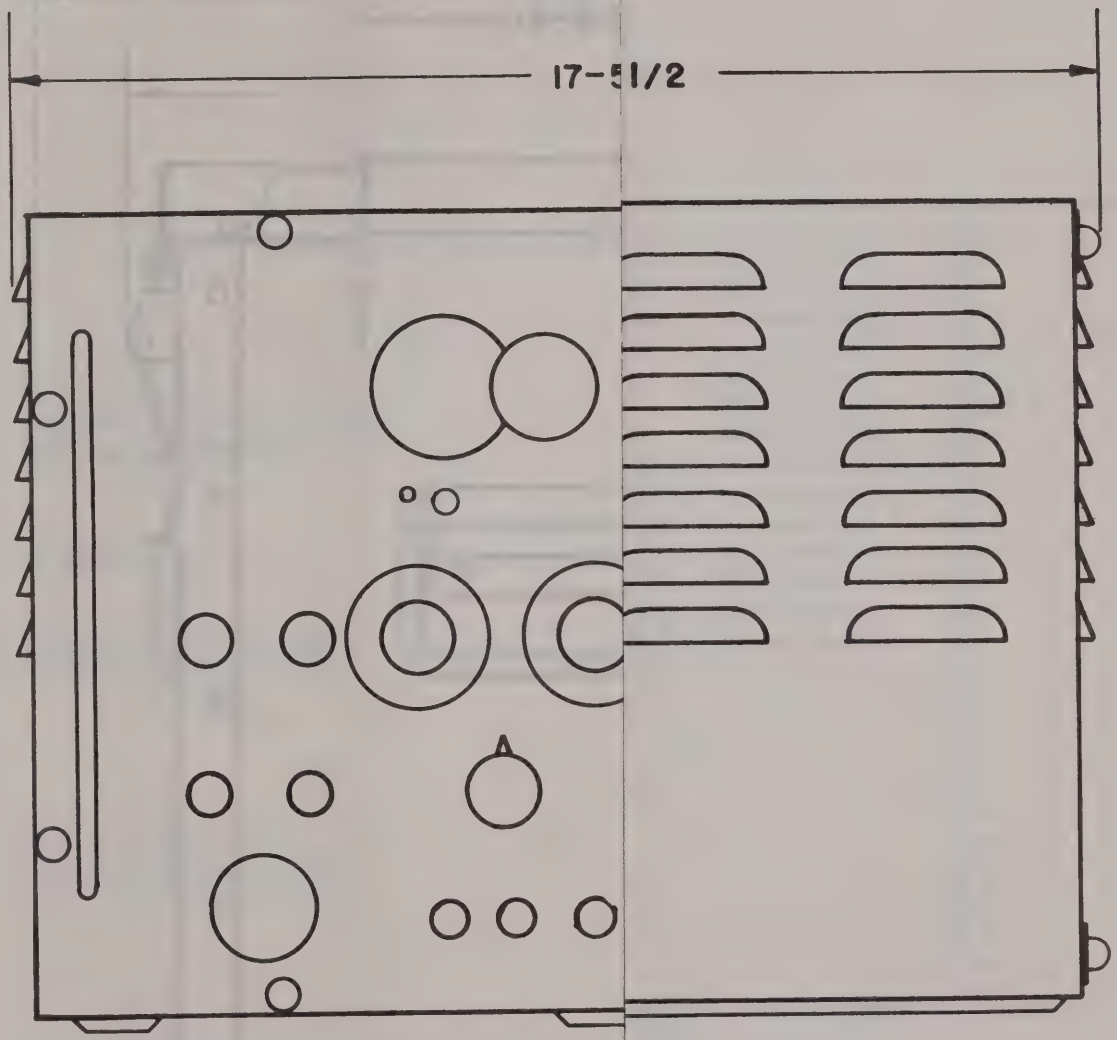


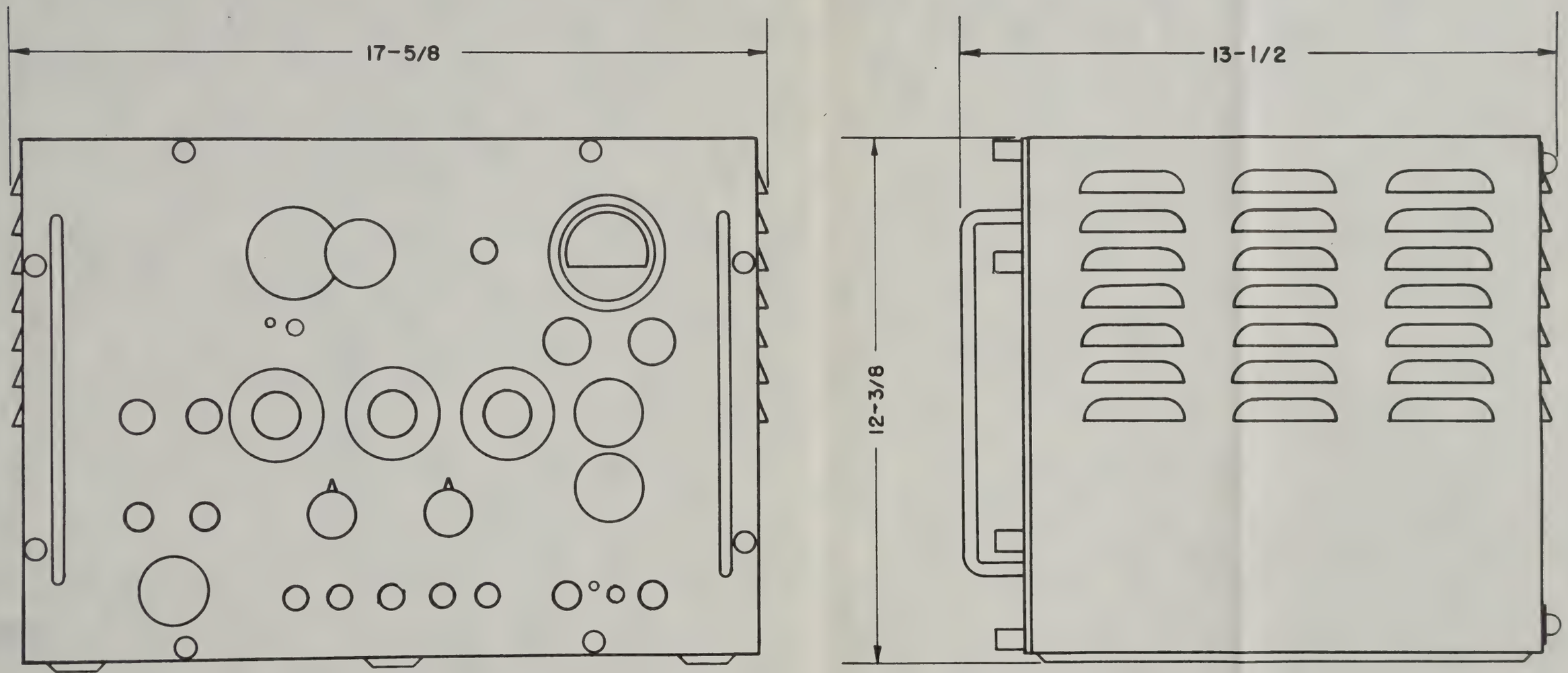
Figure 7-10. Exploded View and Sectional Cutaway View RF Oscillator



NOTE: ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.

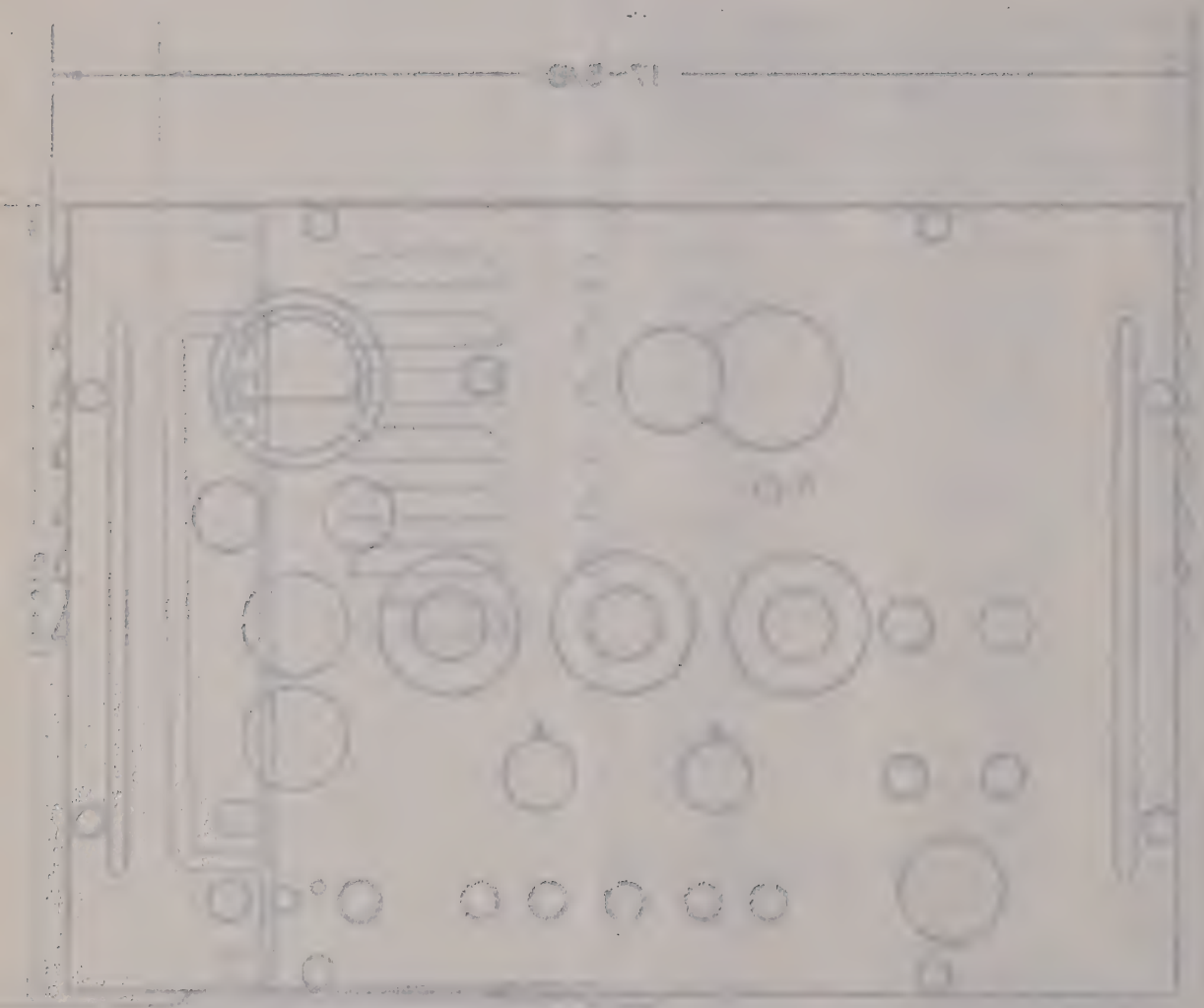
318/U, Overall Dimensions

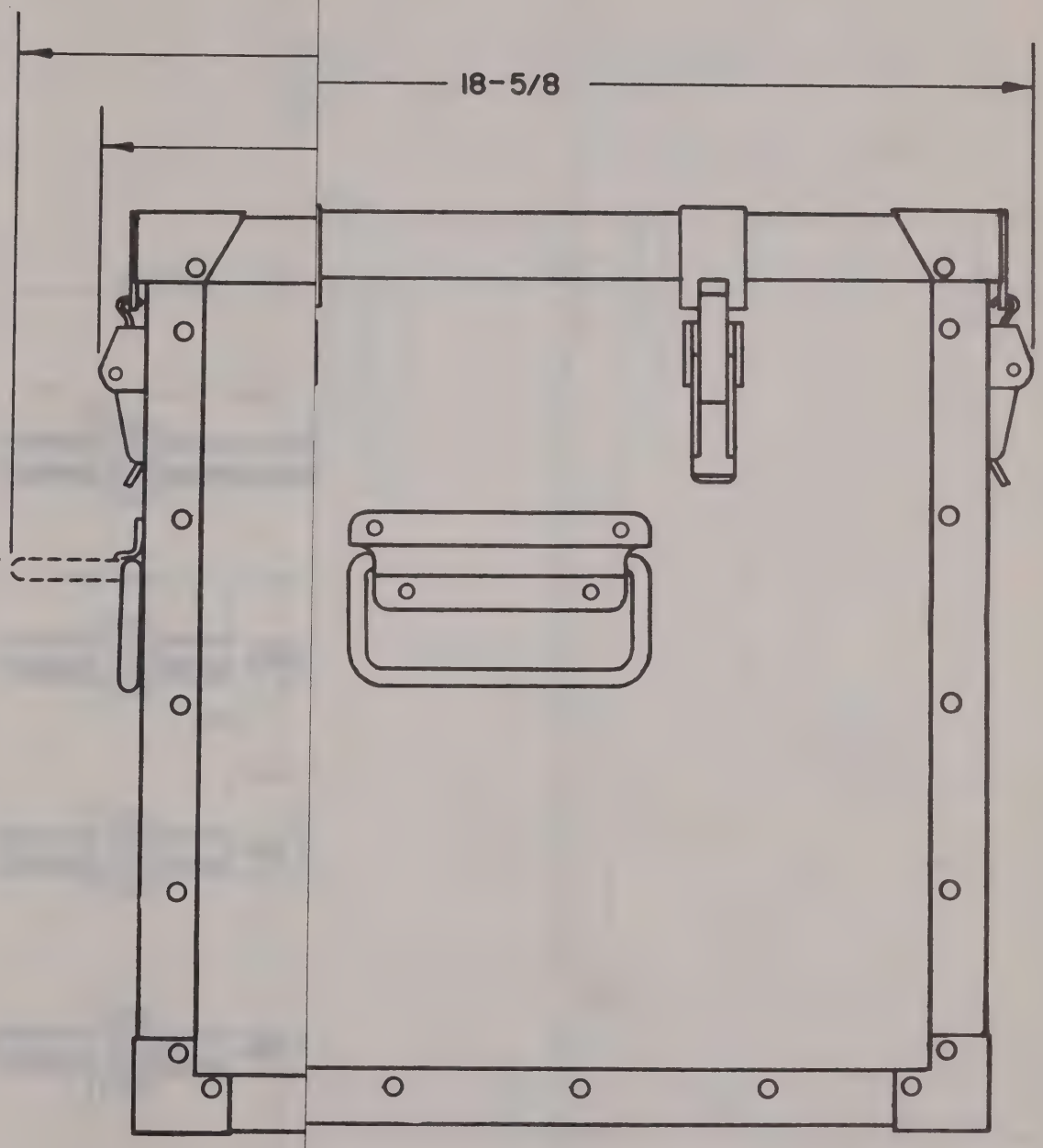
AN 16-35TS418-3



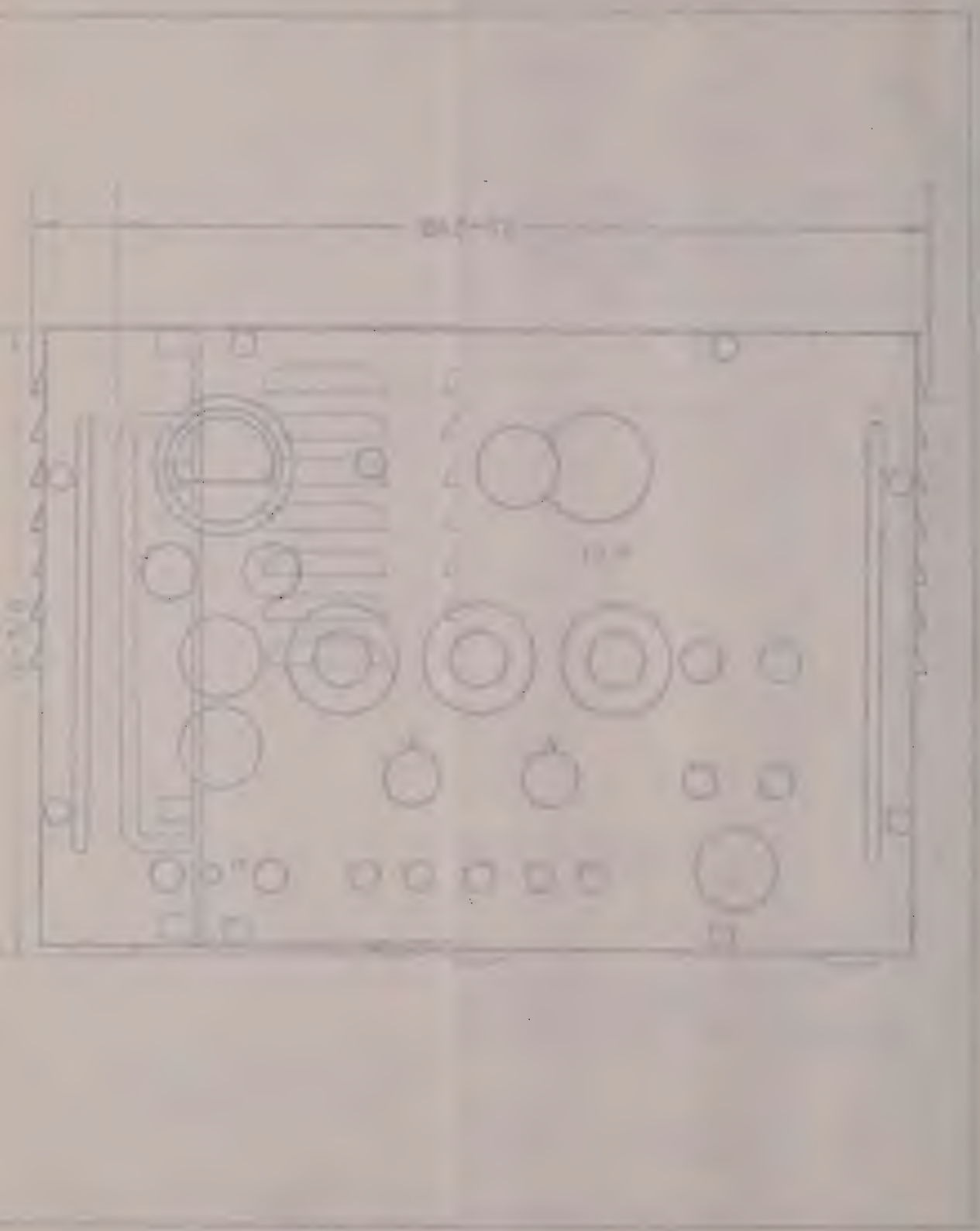
NOTE: ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.

Figure 7-11. Signal Generator TS-418/U, Overall Dimensions





e 7-12. Transit Case CY-741/U, Overall Dimensions



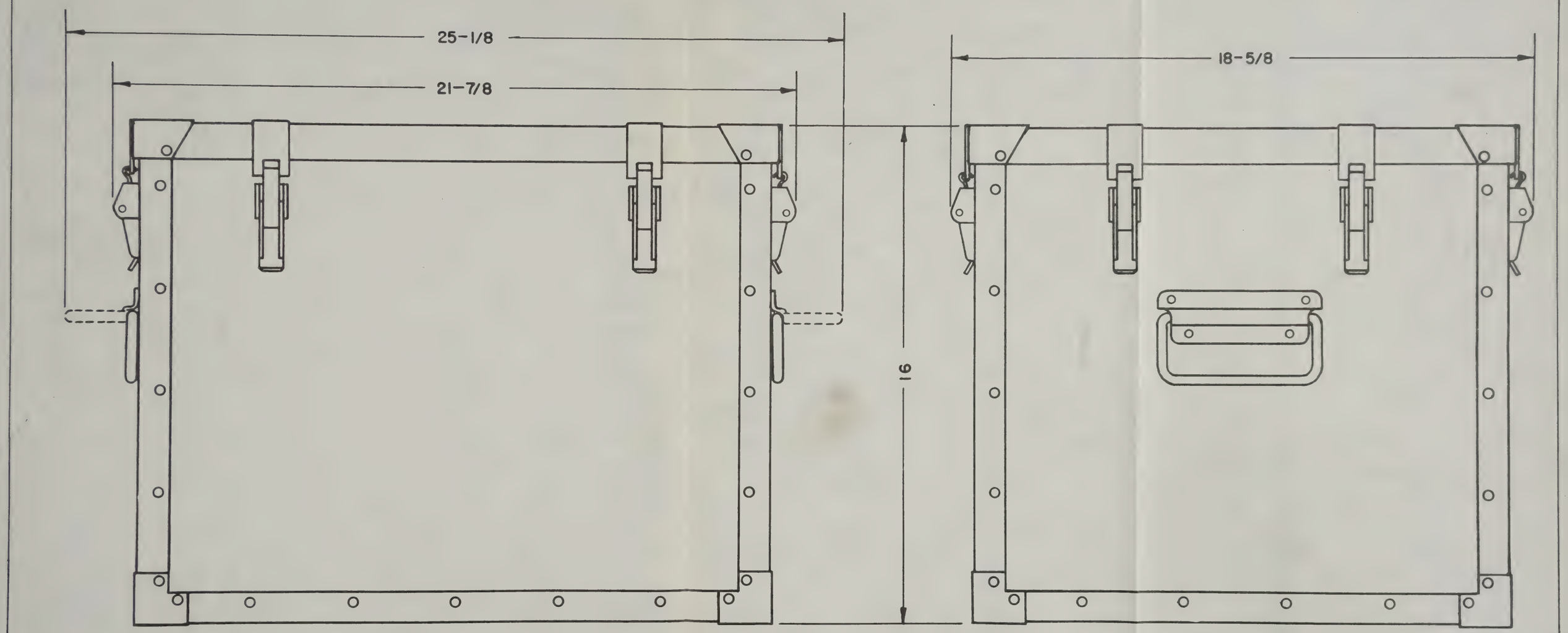
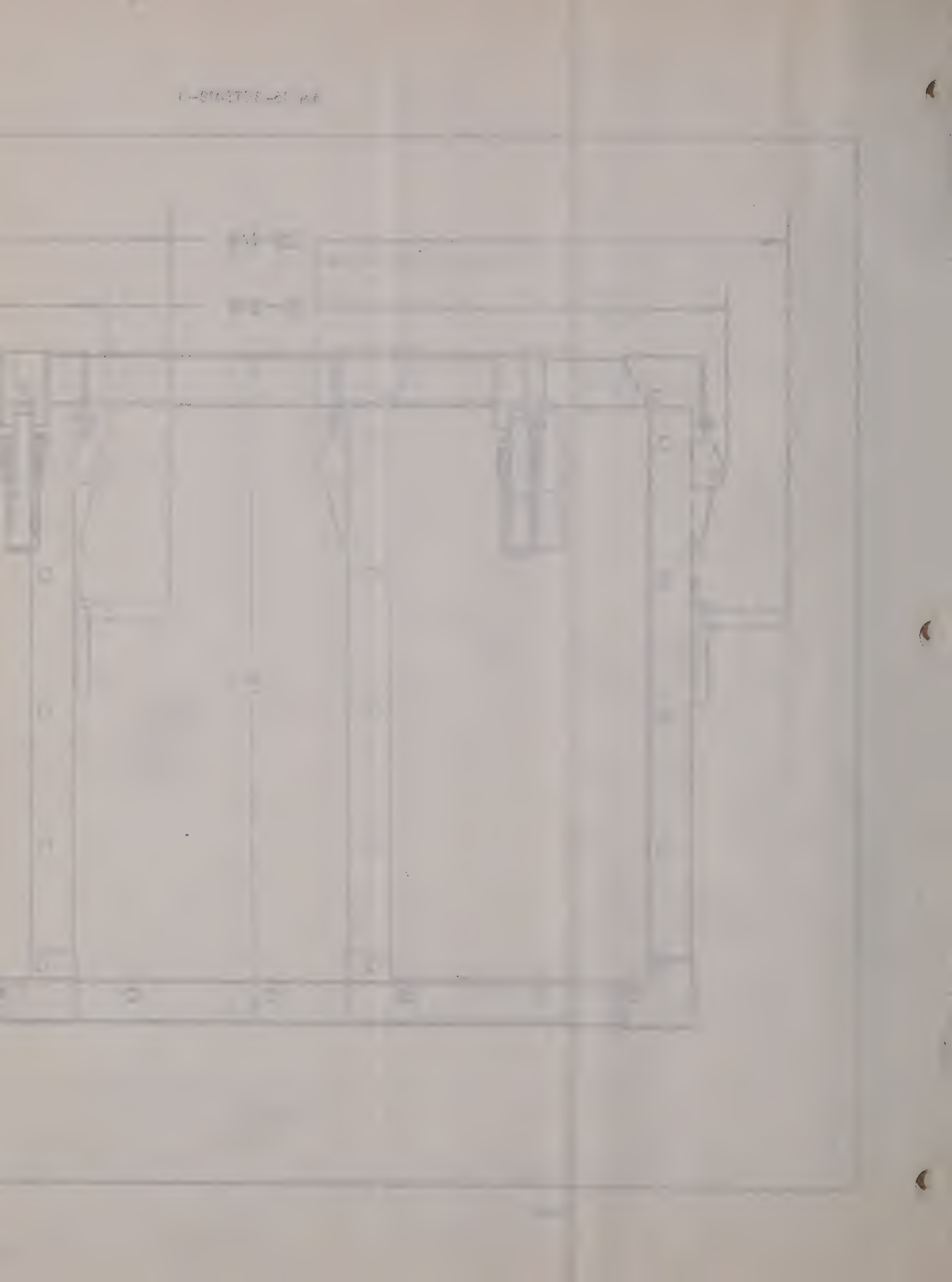
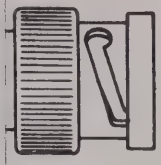


Figure 7-12. Transit Case CY-741/U, Overall Dimensions



ASSEMBLY

NUT

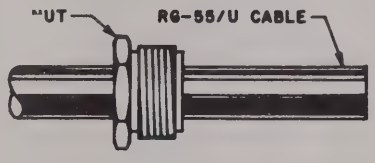


SHELL

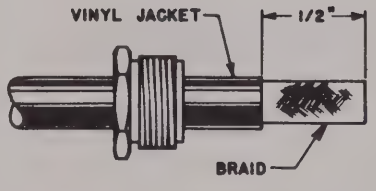
OUTLINE

PROCEDUR

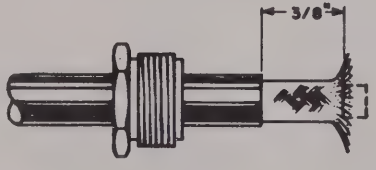
PROCEDURE



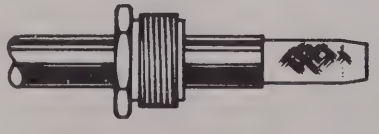
1. CUT OFF SHARP



2. CUT OFF VINYL JACKET FROM END, BEING CAR TO NICK BRAID.



3. CUT OFF INNER INSULA WIRE UNDER BRAID 3/8 VINYL JACKET.



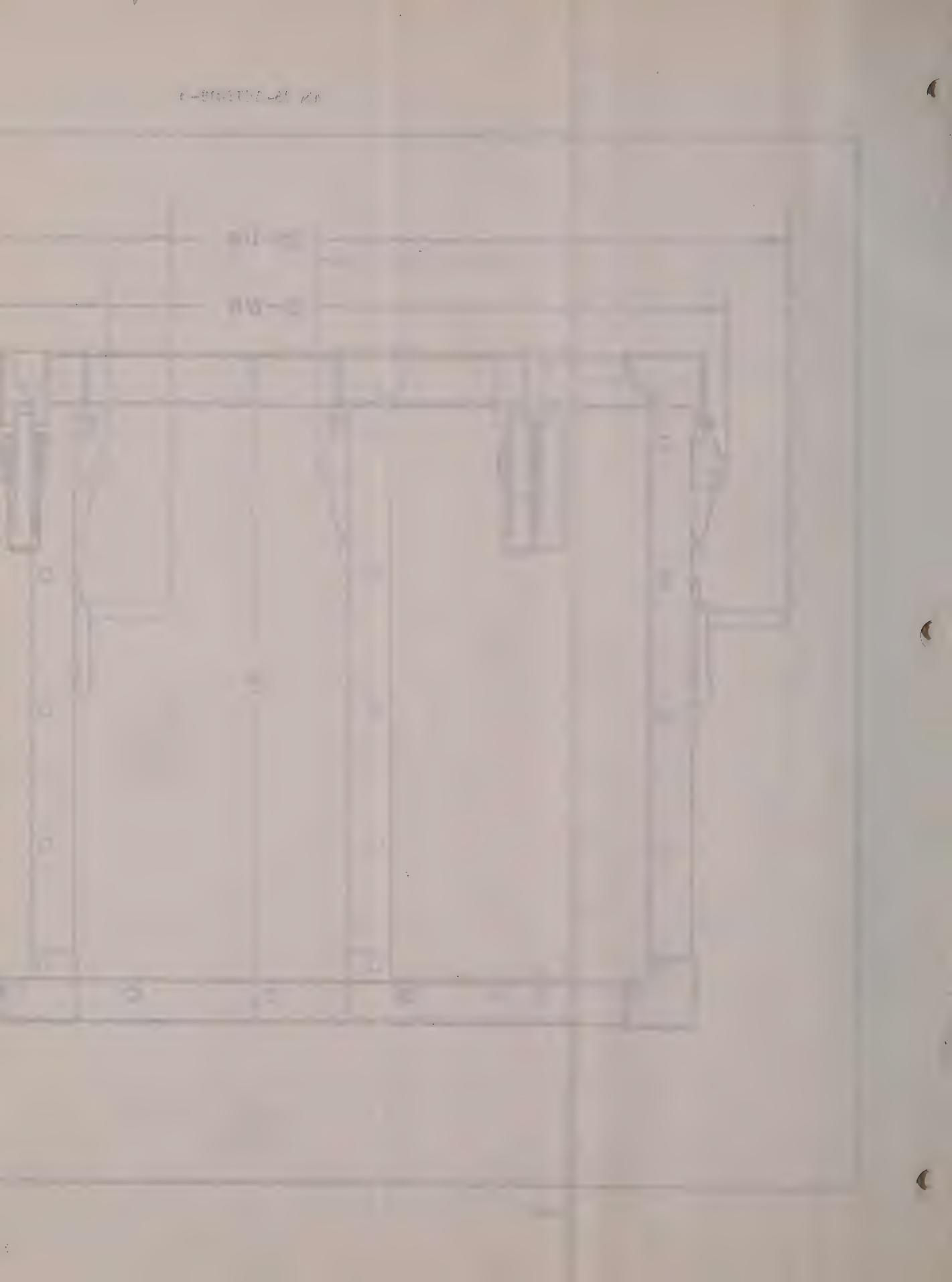
4. TAPER OUTER BRAID.

8. TIN INSIDE HOLE OF MALE CONTACT, TIN CENTER CONDUCTOR OF CABLE, SLIP MALE CONTACT IN PLACE AND SOLDER, REMOVE EXCESS SOLDER.

9. COAT END OF DIELECTRIC WITH POLYSTYRENE CEMENT AND PUSH CABLE INTO SHELL AS FAR AS IT WILL GO.

10. SLIDE NUT INTO SHELL AND SCREW INTO PLACE WITH A WRENCH UNTIL TIGHT.

BNC CONNECTORS.

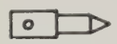


AN 16-35TS418-3

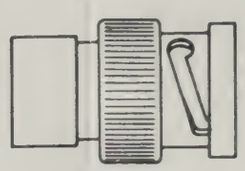
ASSEMBLY OF BNC CONNECTORS TO RG-55/U CABLE

NUT

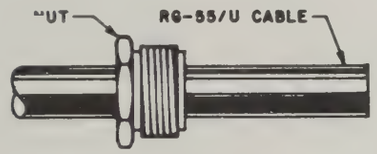
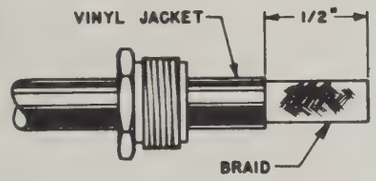
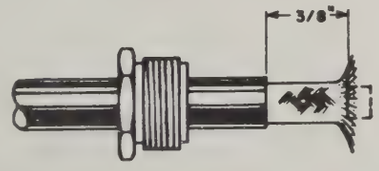
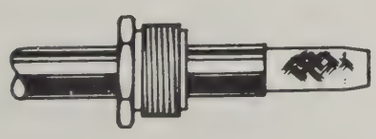
SLEEVE ASSEMBLY

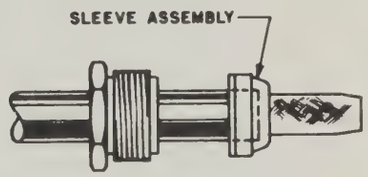
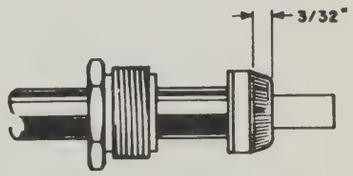
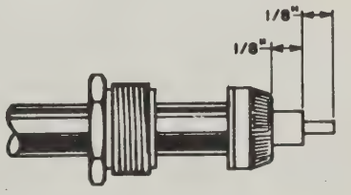


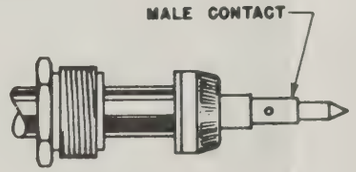
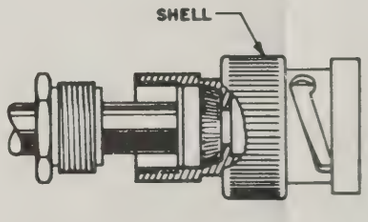
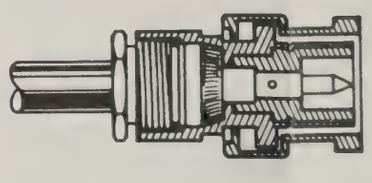
CONTACT, MALE



SHELL

OUTLINE	PROCEDURE
	1. CUT OFF SHARP
	2. CUT OFF VINYL JACKET 1/2 INCH FROM END, BEING CAREFUL NOT TO NICK BRAID.
	3. CUT OFF INNER INSULATION AND WIRE UNDER BRAID 3/8 INCH FROM VINYL JACKET.
	4. TAPER OUTER BRAID.

OUTLINE	PROCEDURE
	5. SLIDE SLEEVE ASSEMBLY OVER TAPERED BRAID TO FIT TIGHT AGAINST VINYL JACKET.
	6. WITH SLEEVE ASSEMBLY IN PLACE COMB OUT BRAID, FOLD BACK SMOOTH AS SHOWN, AND TRIM TO 3/32 INCH FROM END.
	7. CUT INNER DIELECTRIC 1/8 INCH FROM BRAID, BEING CAREFUL NOT TO NICK INNER CONDUCTOR AND CUT OFF INNER CONDUCTOR 1/8 INCH FROM END OF DIELECTRIC.

OUTLINE	PROCEDURE
	8. TIN INSIDE HOLE OF MALE CONTACT, TIN CENTER CONDUCTOR OF CABLE, SLIP MALE CONTACT IN PLACE AND SOLDER, REMOVE EXCESS SOLDER.
	9. COAT END OF DIELECTRIC WITH POLYSTYRENE CEMENT AND PUSH CABLE INTO SHELL AS FAR AS IT WILL GO.
	10. SLIDE NUT INTO SHELL AND SCREW INTO PLACE WITH A WRENCH UNTIL TIGHT.

NOTE: THIS ASSEMBLY PROCEDURE APPLIES TO BNC CONNECTORS.

Figure 7-13. RF Cable CG-546/U (6'0") and Video Cord CG-546/U (8'0"), Fabrication Data

SECTION VIII

DIFFERENCE DATA SHEETS

These Difference Data Sheets contain instructions and information pertaining only to Signal Generator TS-418B/U. The instructions contained in preceding sections of this handbook apply except for the differences listed on these data sheets.

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TS-418B/U

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- Adjusting the Oscillator 8-3
- To Modulate the Oscillator with an External Pulse 8-3

Theory of Operation
- Block Diagram 8-3
- RF Oscillator 8-3
- Modulator Section 8-3
- Free Running 8-3
- External Sine Waves 8-3
- Limiter 8-3
- Delay Multivibrator 8-3
- Sync Out Circuits 8-3
- CW and AM Operation 8-4
- Power Supply 8-4

Table of Replaceable Parts
- Parts List 8-4

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8–2	Signal Generator TS-418B/U, Bottom View with Instrument Case Removed, showing location of Delay Stability (R-369)	8-2
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8–4	Signal Generator TS-418B/U, Modulator Section Block Diagram	8-5
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8–6	Signal Generator TS-418B/U, External Negative Pulse Sync Circuit	8-6
8–7	Signal Generator TS-418B/U, External Sine Wave Sync Circuit	8-7
8–8	Signal Generator TS-418B/U, Limiter and Delay Multivibrator	8-7
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8–10	Signal Generator TS-418B/U, External Amplitude Modulation Circuit	8-8
8–11	Signal Generator TS-418B/U, Schematic Diagram	8-9
8–12	Signal Generator TS-418B/U, Simplified Schematic of Syne Selector Switch S-302	8-11
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8–15	Signal Generator TS-418B/U, Front Panel Controls	8-17

Figure 8-1. Signal Generator TS-418B/U—Front Panel View

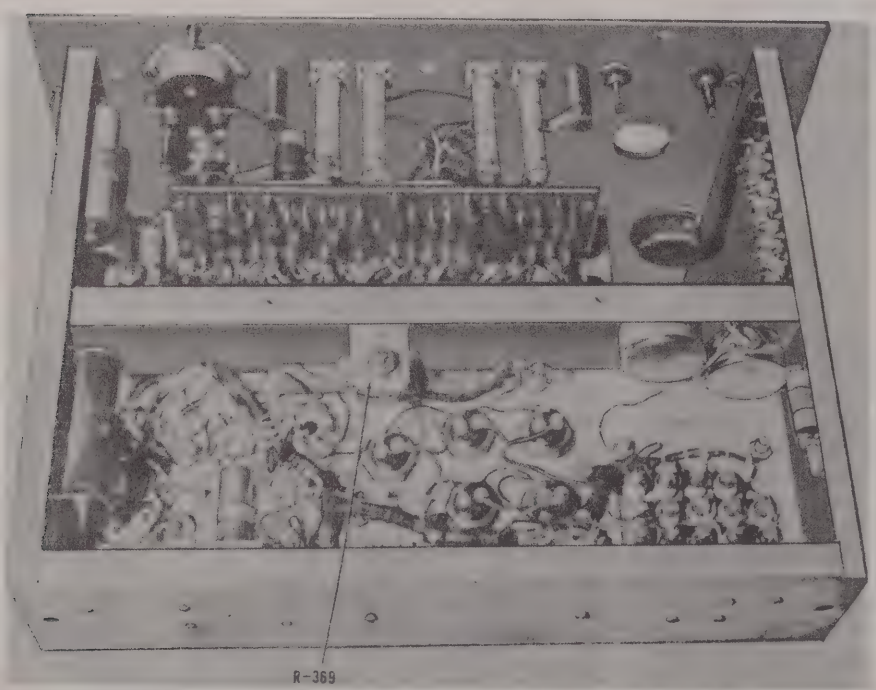


Figure 8-2. Signal Generator TS-418B/U, Bottom View with Instrument Case Removed Looking Toward Front Panel Showing the Delay Stability

SIGNAL GENERATOR TS–418B/U

THE INSTRUCTIONS CONTAINED IN PRECEDING SECTIONS OF THIS HANDBOOK APPLY EXCEPT FOR THE DIFFERENCES LISTED IN THIS DATA SHEET.

OPERATION AND ADJUSTMENT

ADJUSTING THE OSCILLATOR. (Referring to Section II, paragraph 3 b (3)): Changed as follows; Set Control 7 to OFF position and adjust ZERO SET control so that power level meter reads exactly at ZERO SET (index line at left end of meter scale arc). If it is not possible to do this, set the ZERO SET control approximately to the middle of its rotation and after unscrewing the plug adjust the COARSE ZERO SET does not need readjustment unless large excursions of ambient temperature are encountered. Replace the plug tightly after any adjustment of the COARSE ZERO SET control.

TO MODULATE THE OSCILLATOR WITH AN EXTERNAL PULSE. (Referring to Section II, paragraph 3 f (1), (2) and (3)): Change as follows;

Set switch 6 to AM position.

With the modulating signal disconnected, ZERO and POWER SET as in steps b (3), (4), but with control 6 to AM, connect the modulating signal to EXT MOD terminal.

Connect the external sinusoidal voltage to the EXT MOD terminal of the Signal Generator TS-418B/U. With switch 6 set to AM it is not possible to pulse modulate the RF carrier 100%, that is with blank periods between the pulse periods.

THEORY OF OPERATION

BLOCK DIAGRAM. (Referring to Section III, paragraph 2): Changed as follows;

The basic circuit of Signal Generator TS-418B/U consists of four sections shown in figure 3–1: the Modulator, the RF Oscillator, the output system, and the Power Supply. The Modulator keys the Oscillator to produce the desired type of RF output. The output system determines the amount of RF power available to the load and includes a direct-reading output level control. The Power Supply provides plate and filament power for the Modulator and Oscillator. A complete schematic diagram of the system is given in figure 8–11.

RF OSCILLATOR. (Referring to Section III, paragraph 3 (b)): The NOTE is changed as follows;

Note

The accuracy of the calibration of power output varies slightly with the carrier frequency setting, the maximum error being less than one-half decibel over the whole frequency range.

MODULATOR SECTION. (Referring to Section III, paragraph 4 a): Change as follows;

GENERAL.—The Modulator section includes tubes V-301 (12AX7); V-302, V304 (12AT7); V-303, V-305 (6J6); V-306 (6AG7); and V-307, (6J6). The basic function of the Modulator is to generate a positive pulse of desired characteristics and to apply that pulse to the grid of the RF Oscillator V-201 (2C36) so that V-201 will oscillate for the duration of the pulse. The pulse can, if desired, be synchronized with an external pulse or sine-wave voltages.

FREE RUNNING. (Referring to Section III, paragraph 4 b (1)): The NOTE is changed as follows;

Note

When the Blocking Oscillator is operated in in the free-running condition, the secondary winding of T-301 is placed in series with either R-316 or R-317. These 1000 ohm potentiometers are connected as variable resistors and are adjusted to provide pulse rate correction independently for each range.

EXTERNAL SINE WAVES. (Referring to Section III, paragraph 4 b (4)): All figure references are changed;

Figure 7–2, changed to Figure 8–12.
Figure 3–7, changed to Figure 8–5.
Figure 3–8, changed to Figure 8–6.
Figure 3–9, changed to Figure 8–7.

LIMITER. (Referring to Section III, paragraph 4 c, first sentence): The figure reference is changed;

Figure 3–10, changed to Figure 8–8.

DELAY MULTIVIBRATOR. (Referring to Section III, paragraph 4 d): Following the second paragraph additional information is required

Potentiometer R-369, Delay Stability, is adjusted to give the correct bias for V-303. If the bias is too low, the delay circuit will free-run. If the bias is too high, the circuit will act as an amplifier rather than a Multivibrator near minimum delay resulting in approximately a one microsecond jump in delay as the Delay control is varied.

SYNC OUT CIRCUITS. (Referring to Section III, paragraph 4 e): Changed as follows;

In addition to the output pulse for the Delay Multivibrator, a parallel output is taken from the plate of V-302B, the Series Diode Limiter, in order to produce a positive video SYNC OUT pulse. The negative pulse from V-302B is coupled to inverting amplifier tube V-304A (12AT7). Coupling capacitor

THE INSTRUCTIONS CONTAINED IN PRECEDING SECTIONS OF THIS HANDBOOK APPLY EXCEPT FOR THE DIFFERENCES LISTED IN THIS DATA SHEET.

C-322 is of small capacitance (24 micromicrofarads) to minimize loading effects on the Delay Multivibrator. The sharpened leading edge of the positive output pulse from V-304A is applied as a trigger to Blocking Oscillator V-304B. This tube, normally biased beyond cutoff (about 16 volts negative) by voltage divider R-324 and R-323, generates a sharp positive pulse which is taken across the cathode resistor R-236 and applied as the SYNC OUT pulse to output terminal J-303. This pulse has an amplitude of about 65 volts without external load and about 45 volts when the rated load of 500 ohms shunted by 1500 micromicrofarads is used. From the simplified schematic, Figure 8–9 it will be seen that the leading edge of the SYNC OUT pulse is essentially coincident with that of the original externally applied SYNC IN pulse, occurring at time t_1.

The positive Delay pulse is also used to trigger the Pulse Width Multivibrator at a time t_2, that is, a time coincident with the trailing edge of the Delay pulse. After the positive Delay pulse is differentiated in the coupling network, capacitor C-315, and resistors R-334 and R-335, a positive trigger coincident with the leading edge and a negative trigger coincident with trailing edge of the Delay pulse are applied to the grid of V-306 (6AG7) in the Pulse Width Multivibrator negative pulse, being unaffected by the positive pulse.

CW AND AM OPERATION. (Referring to Section III, paragraph 4 i): The following information is added;

The presence of R-370 on AM drops the plate voltage of V-201 (2C36) to a lower value than that used on CW and permits greater percentages of modulation without distortion at the higher oscillator frequencies. It should be noted that lower plate voltage at V-201 will result in a decrease in power output. Thus it is necessary to perform zero and power setting functions on AM before the application of modulation to the EXT MOD jack.

POWER SUPPLY. (Referring to Section III, paragraph 6): The second paragraph is changed as follows;

The full-wave rectifier circuit associated with V-102 (5R4GY) provides a positive output voltage of approximately 400 V dc, as shown on the schematic figure 8–11. The output of the rectifier is regulated by the electronic regulator circuits associated with V-104 (6AG7) and V-105 (6AK5). The regulated positive output voltage may be varied from 100 to 200 V by the setting of resistor R-360 (PWR SET). The normal setting for R-360 is that which places 175 volts on the plate of V-201 when the MOD SELECTOR switch is on CW.

The information in the fourth paragraph is changed as follows;

The full-wave rectifier V-101 (5Y3GT) provides an output of approximately —200 V. A gaseous voltage regulator tube V-107 (OB2) is employed to furnish the stabilized bias supply, —105 V, —30 V, and —10 V taps being provided for various fixed bias applications.

TABLE 8-1. PARTS LIST

REF. SYMBOL	AF STOCK NO. NAVY STOCK NO. ARMY STOCK NO.	NAME OF PART AND DESCRIPTION	FUNCTION	MFR. DES. OR JAN TYPE	CONT. OR GOVT. DWG. OR SPEC. NUMBER
M-301		METER, same as in Signal Generator TS–418/U, except it is type HS2.			
R-118	3300-385291090 R16-R-18681-14-250 3RW29109	RESISTOR, fixed: Wire wound; 6300 ohms ±5%; 9 watt; 3" lg x ½" diam; insulated; inductive; 2 solder terminals.	Part of RC Filter	JAN RW51J-632	JAN-R-11
R-321	R16-R-11480-100 3RC31BF681K	RESISTOR, fixed: Composition; 680 ohms 10%; 1 watt; 1.28" lg x .310" diam; 2 axial wire leads.	Maintains grid voltage of V-303A		
R-323B		RESISTOR, fixed: Same as R-344.			
R-369		RESISTOR, variable: 2500 ohms ±10%; 2 watt; 500V max; $1\frac{1}{16}$" diam x $\frac{9}{16}$" lg; shaft ⅜" lg x .250" diam; linear taper; 3 terminals.	Varied grid voltage of V-303A		
V-304		TUBE, electron: Same as V-302.			

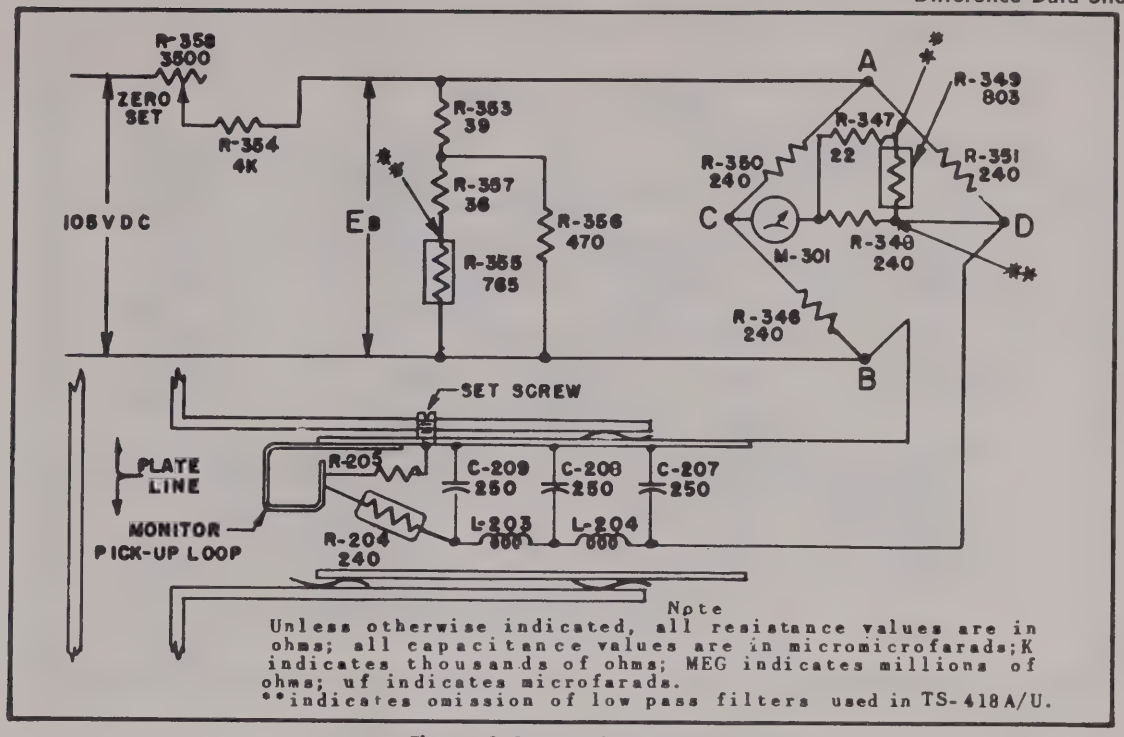


Figure 8-3. Monitor Circuit

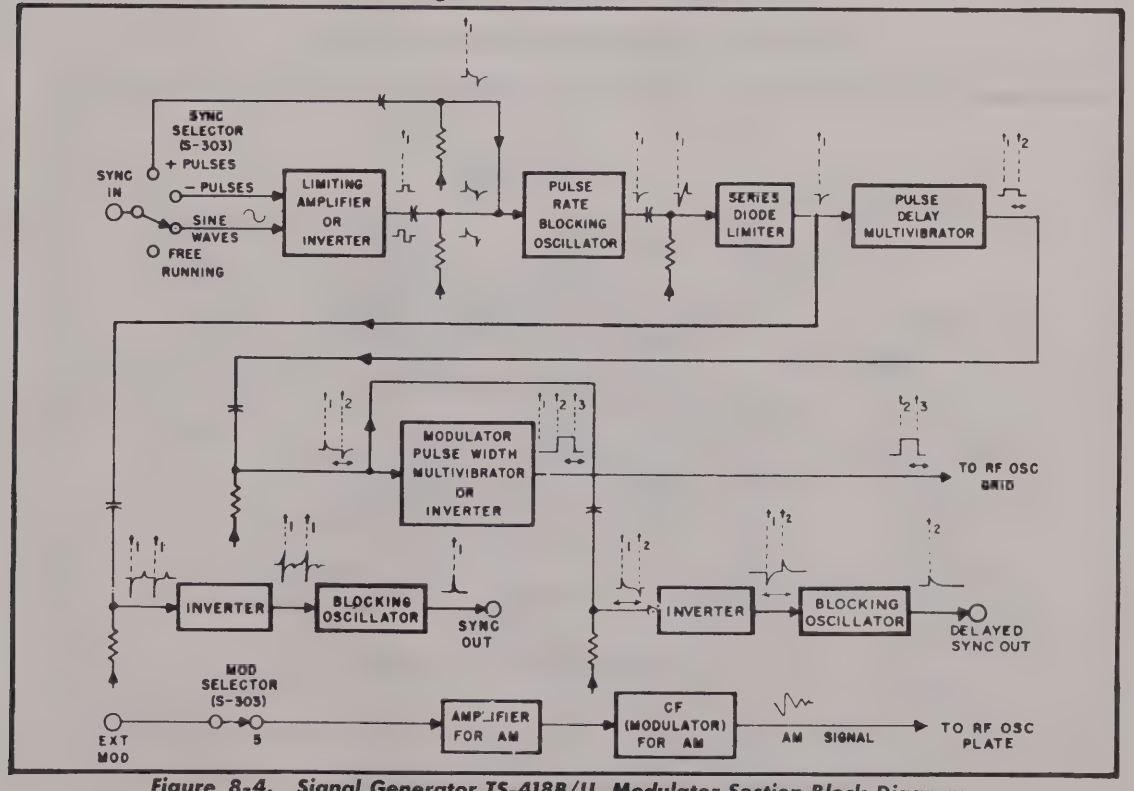


Figure 8-4. Signal Generator TS-418B/U, Modulator Section Block Diagram

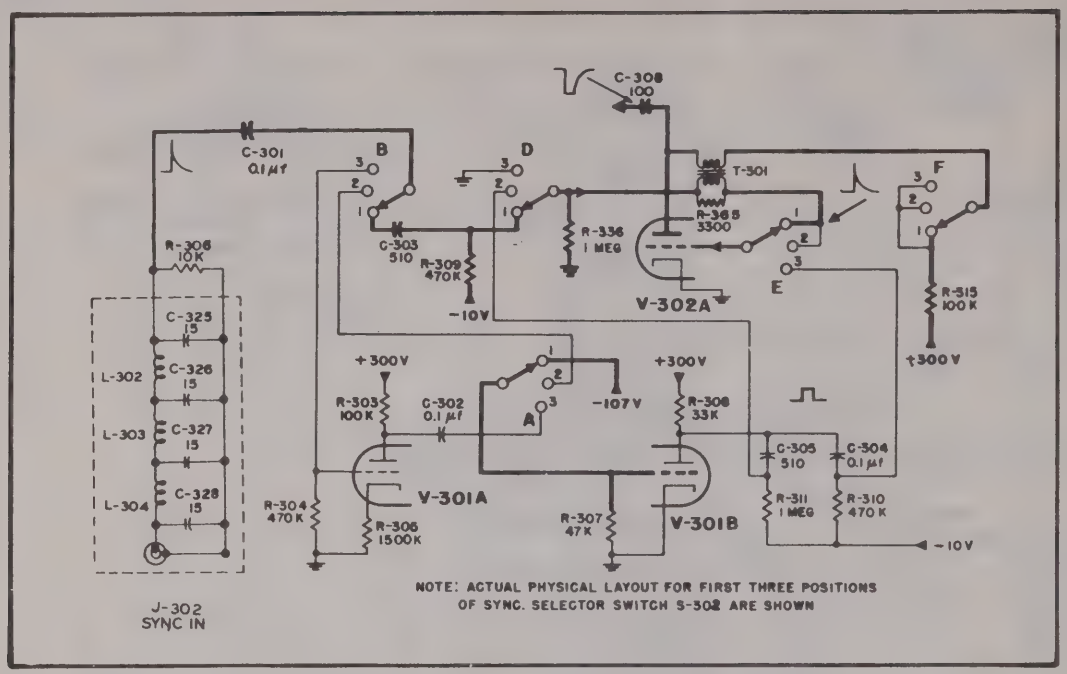


Figure 8-5. External Positive Pulse Sync Circuit

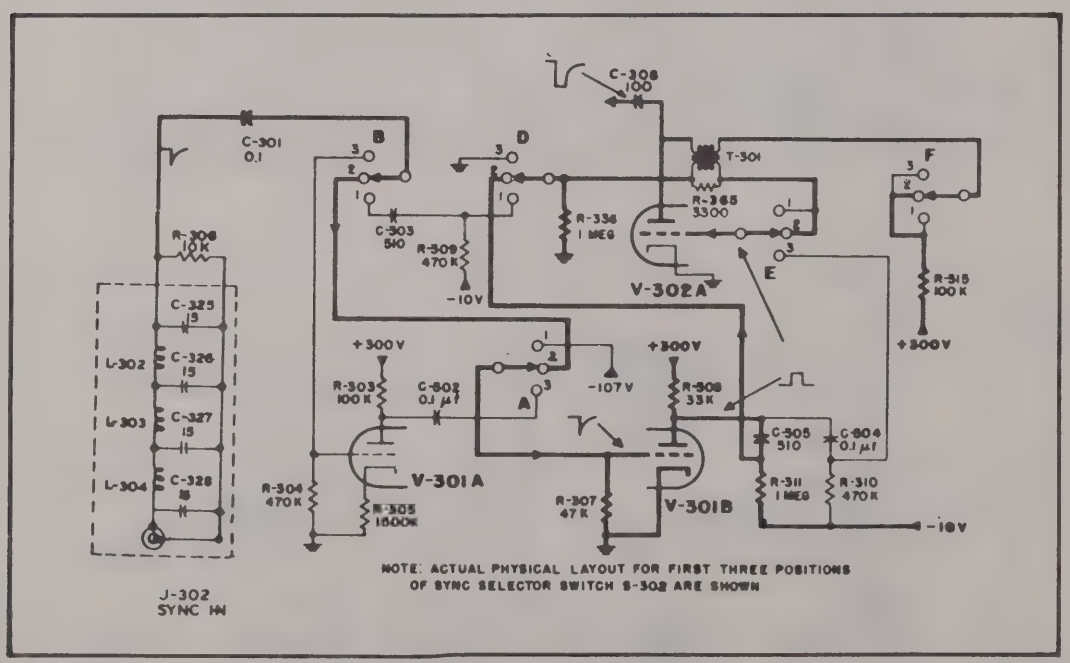


Figure 8-6. External Negative Pulse Sync Circuit

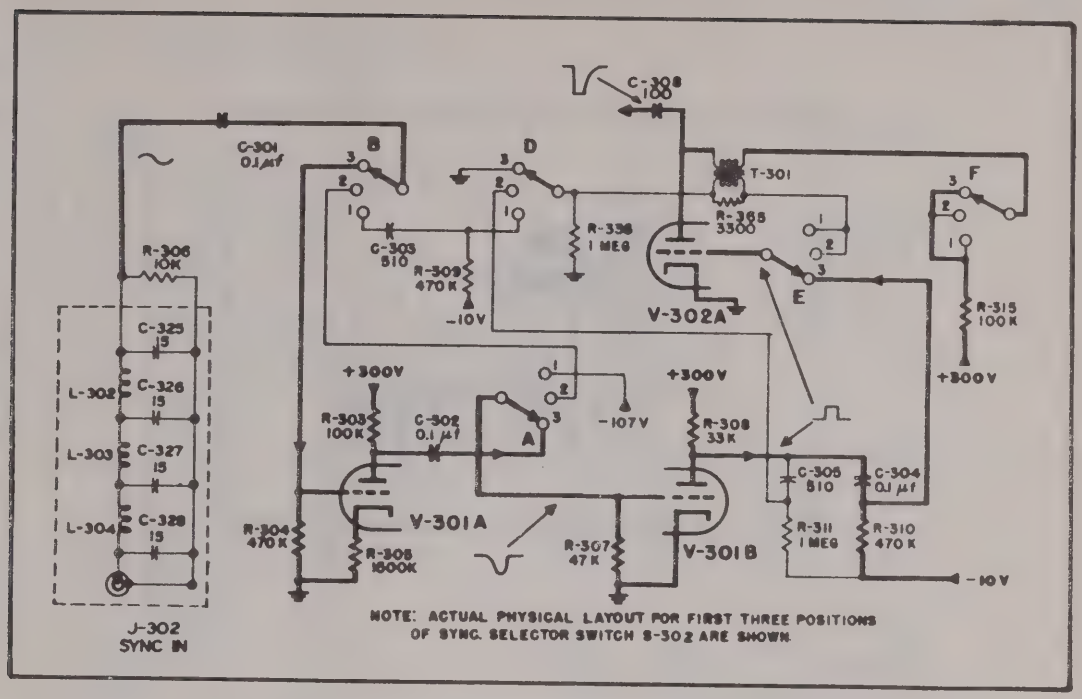


Figure 8-7. External Sine Wave Sync Circuit

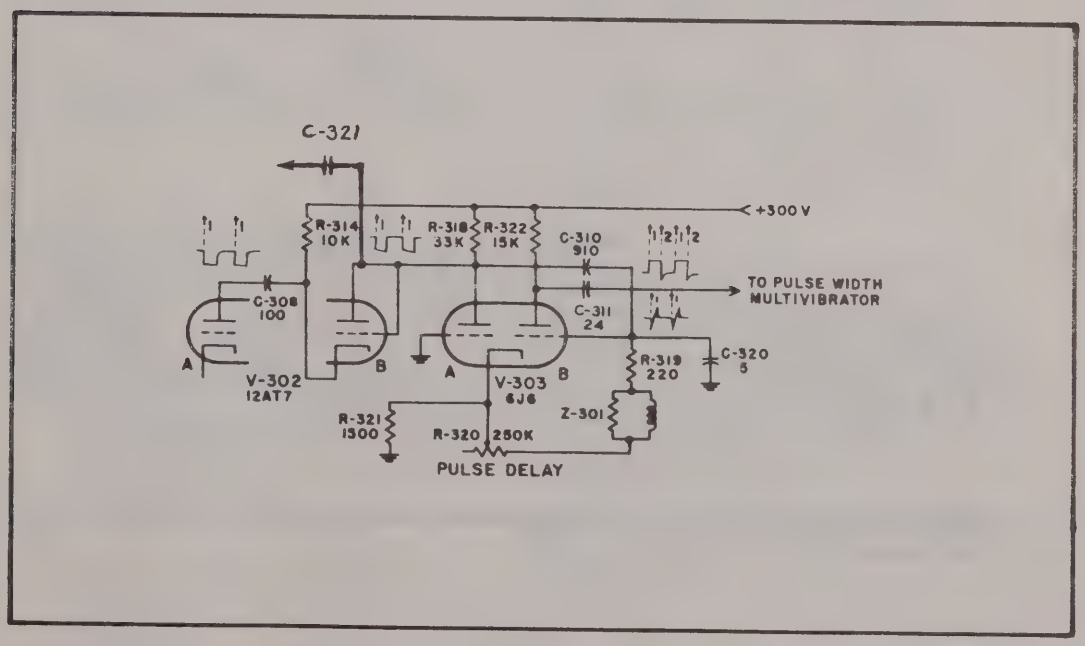


Figure 8-8. Limiter and Delay Multivibrator

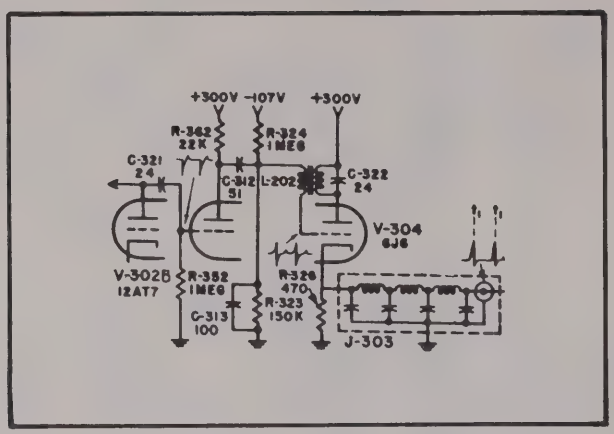


Figure 8-9. Sync Out Pulse Circuit

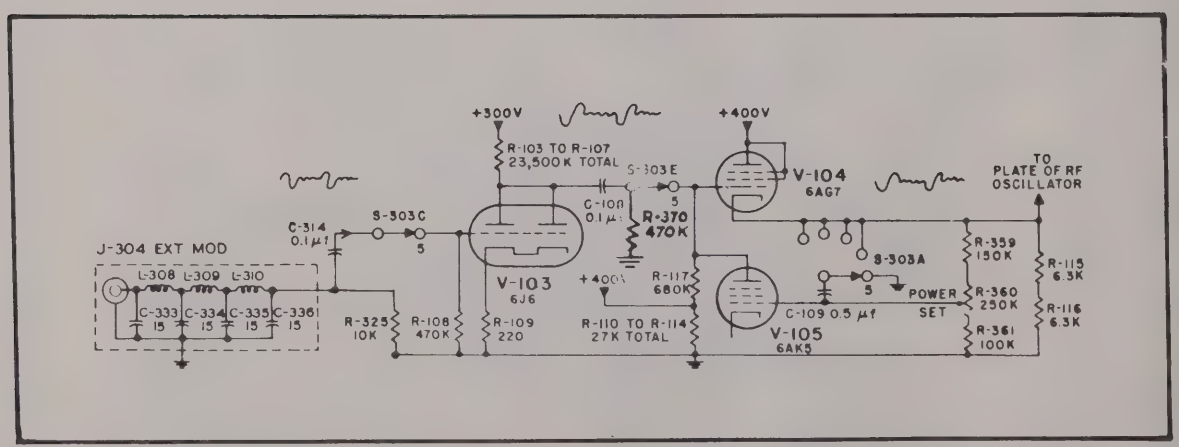


Figure 8-10. External Amplitude Modulation Circuit

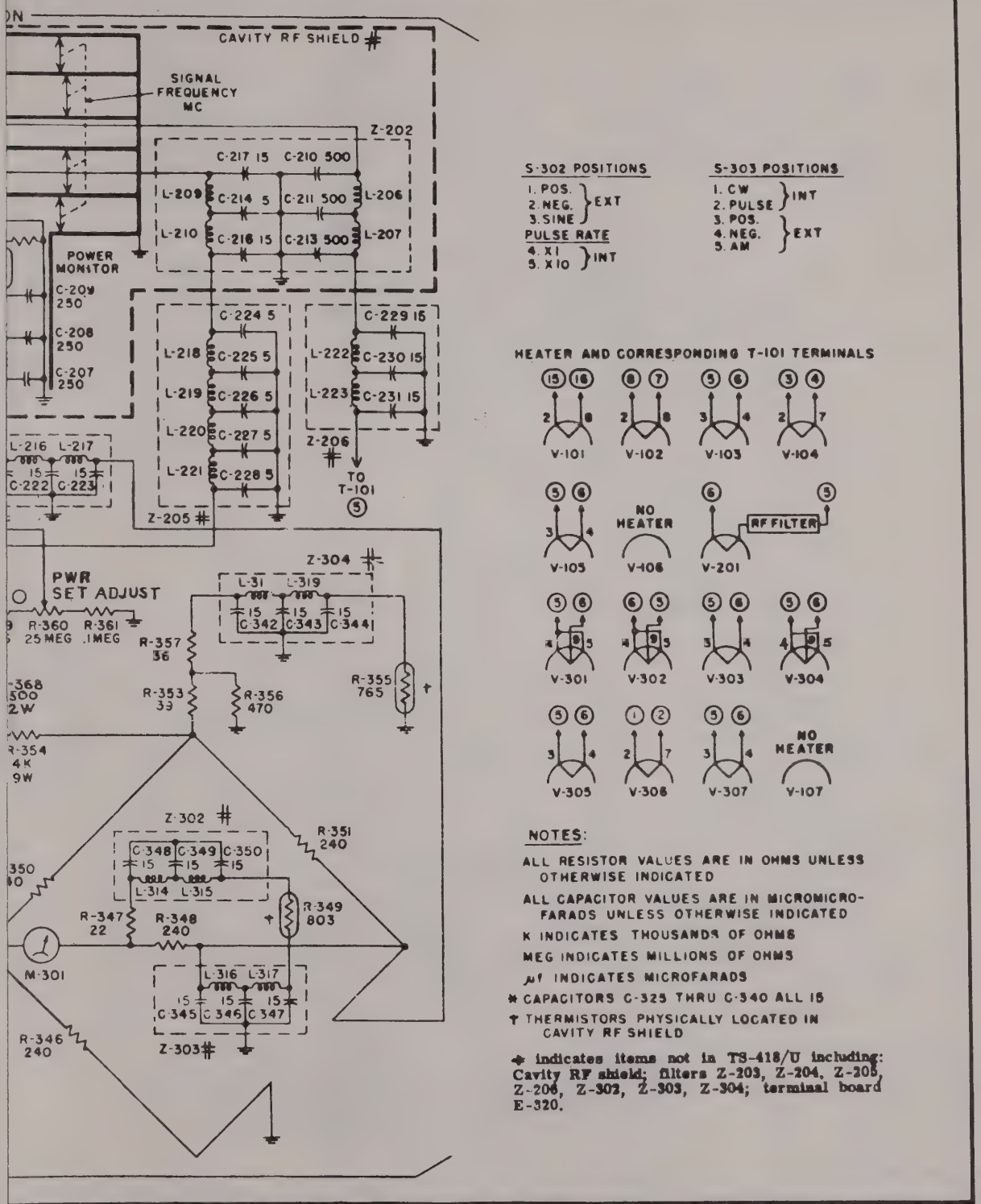


Figure 8-11. Signal Generator TS-418B/U, Schematic Diagram

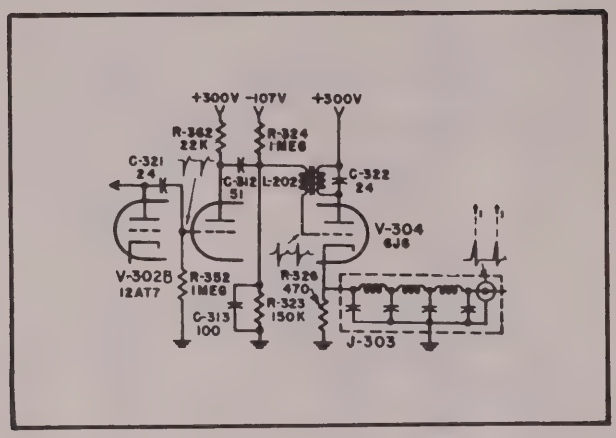


Figure 8-9. Sync Out Pulse Circuit

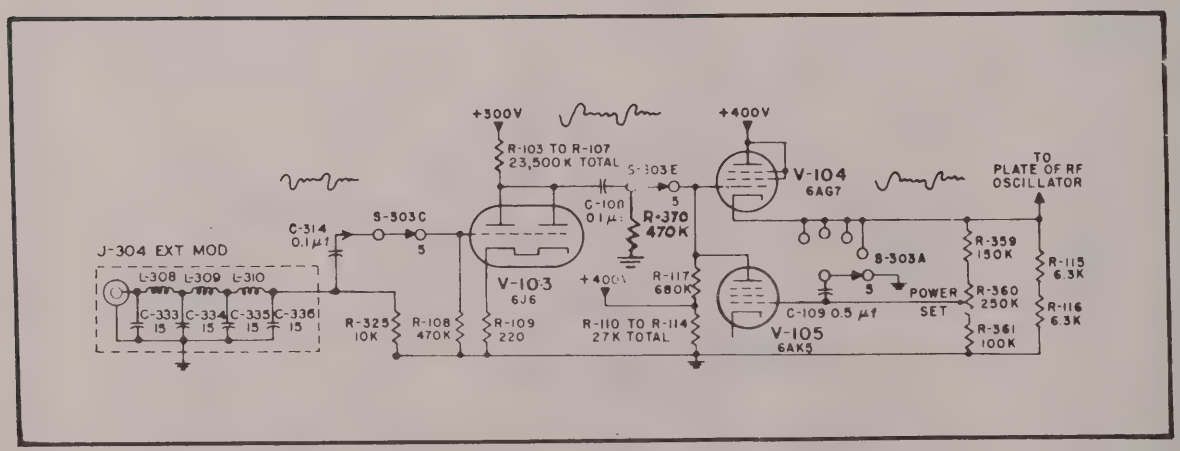
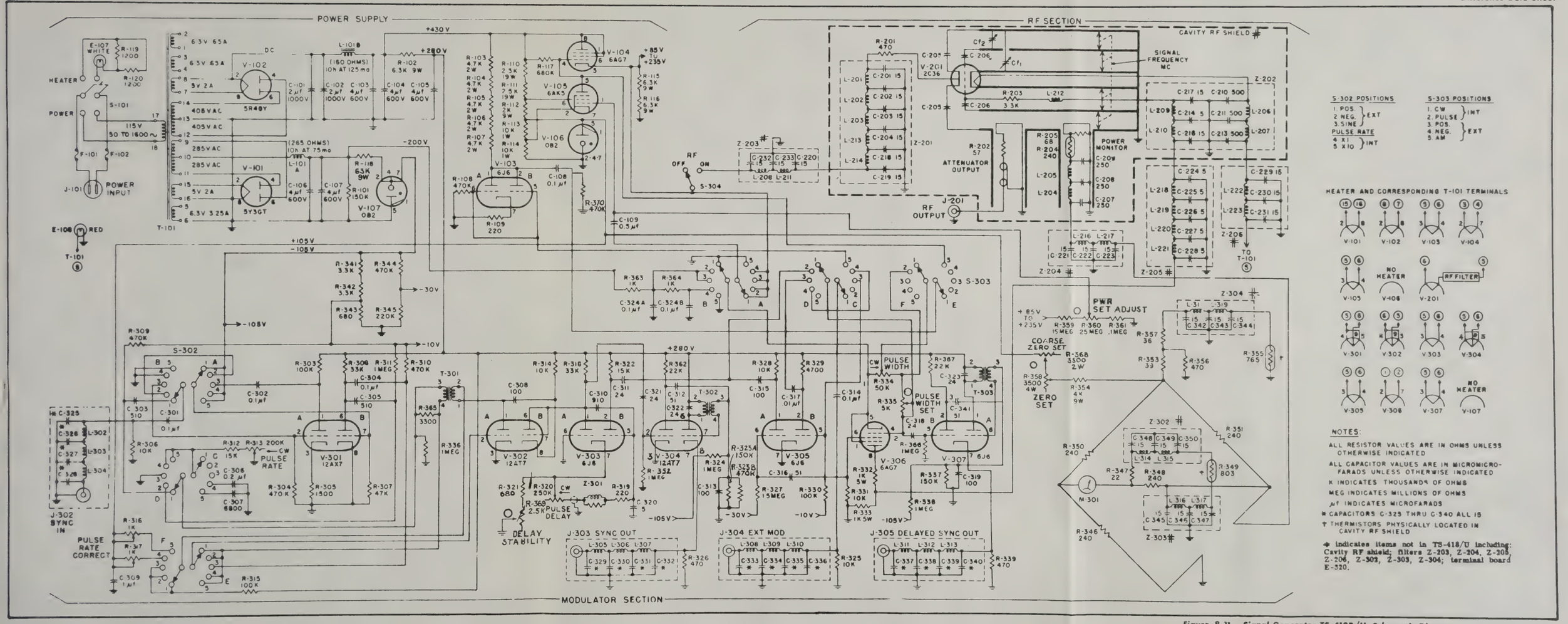


Figure 8-10. External Amplitude Modulation Circuit



S-302 POSITIONS
1. POS. } EXT
2. NEG. } EXT
3. SINE
PULSE RATE
4. X1 } INT
5. X10 } INT

S-303 POSITIONS
1. CW
2. PULSE } INT
3. POS.
4. NEG. } EXT
5. AM

HEATER AND CORRESPONDING T-101 TERMINALS

NOTES:

ALL RESISTOR VALUES ARE IN OHMS UNLESS OTHERWISE INDICATED

ALL CAPACITOR VALUES ARE IN MICROMICROFARADS UNLESS OTHERWISE INDICATED

K INDICATES THOUSANDS OF OHMS

MEG INDICATES MILLIONS OF OHMS

μf INDICATES MICROFARADS

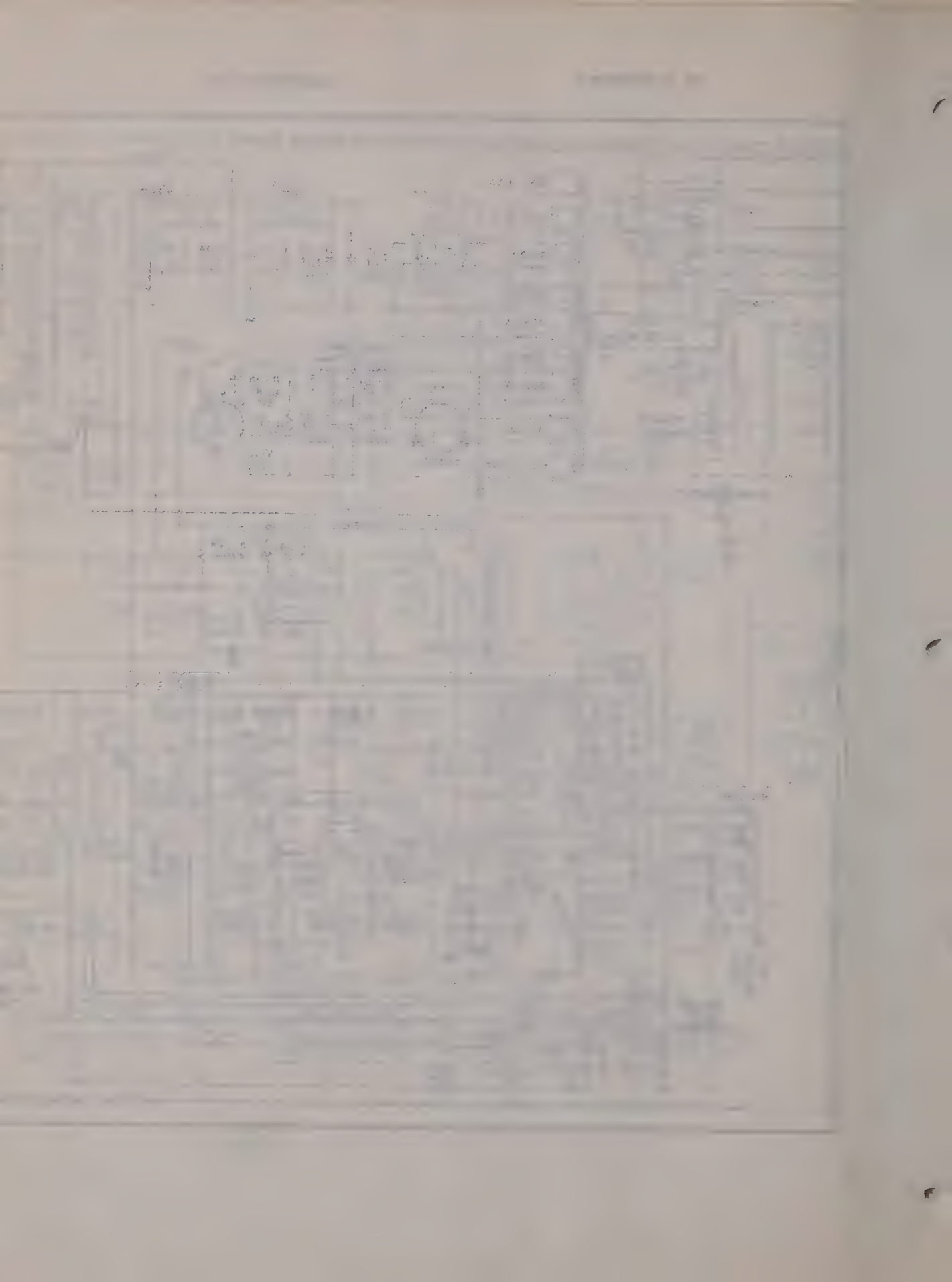
* CAPACITORS C-323 THRU C-340 ALL 1S

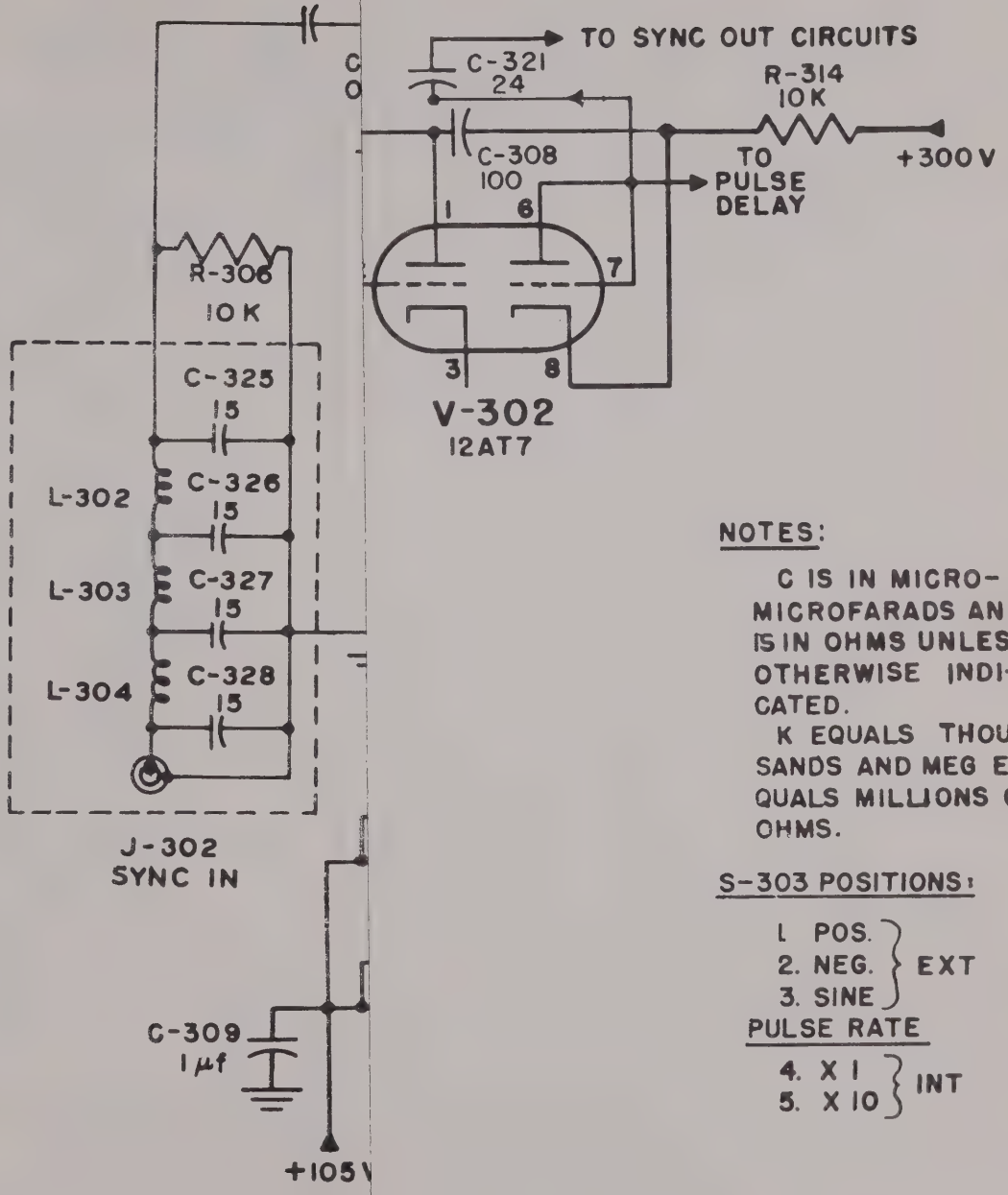
† THERMISTORS PHYSICALLY LOCATED IN CAVITY RF SHIELD

◆ Indicates items not in TS-418/U including: Cavity RF shield; filters Z-203, Z-204, Z-205, Z-206, Z-302, Z-303, Z-304; terminal board E-320.

Figure 8-11. Signal Generator TS-418B/U, Schematic Diagram

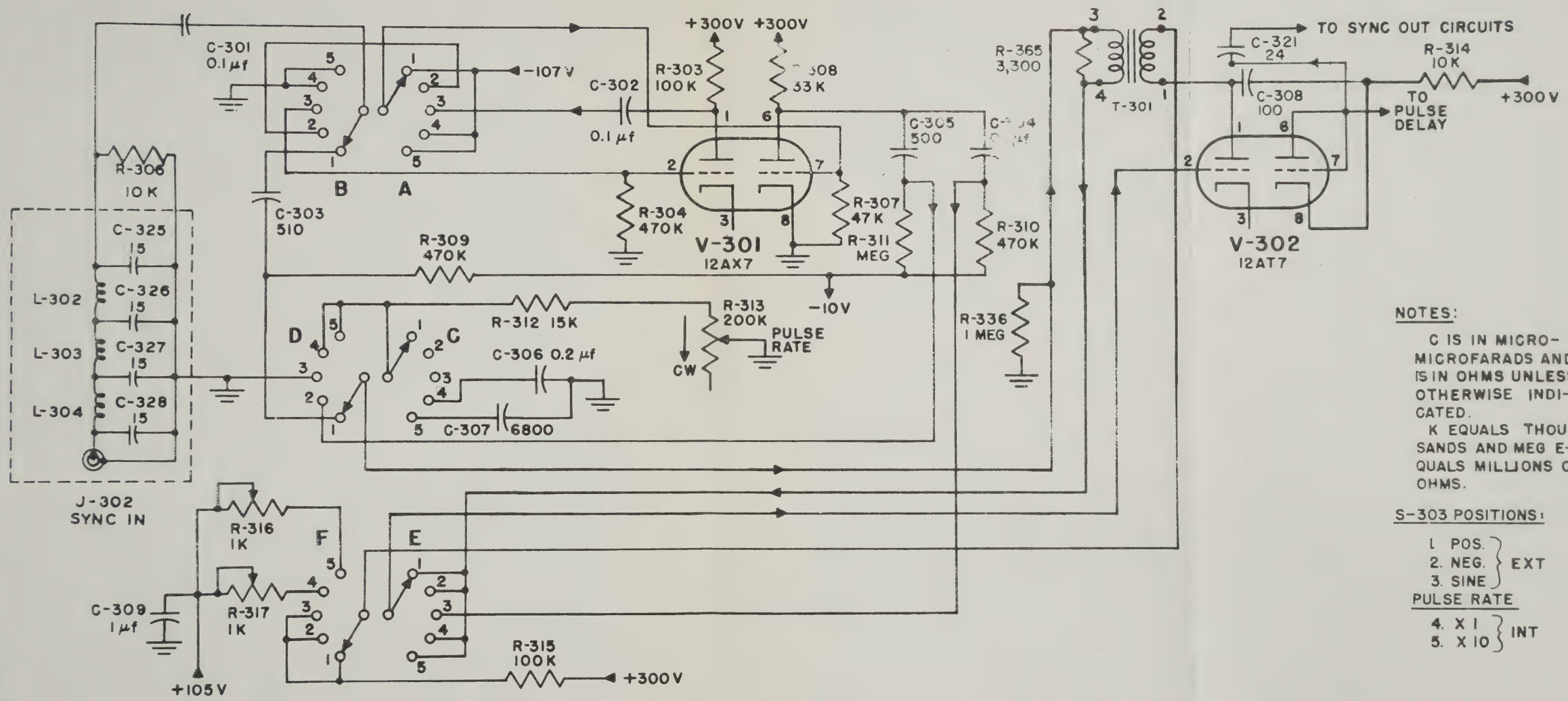
Revised 15 October 1952





or TS-418B/U, Simplified Schematic of Sync Selector Switch S-302

AN 16-30URM49-3



NOTES:

C IS IN MICRO-MICROFARADS AND R IS IN OHMS UNLESS OTHERWISE INDICATED.

K EQUALS THOUSANDS AND MEG EQUALS MILLIONS OF OHMS.

S-303 POSITIONS:

1. POS.
2. NEG.
3. SINE

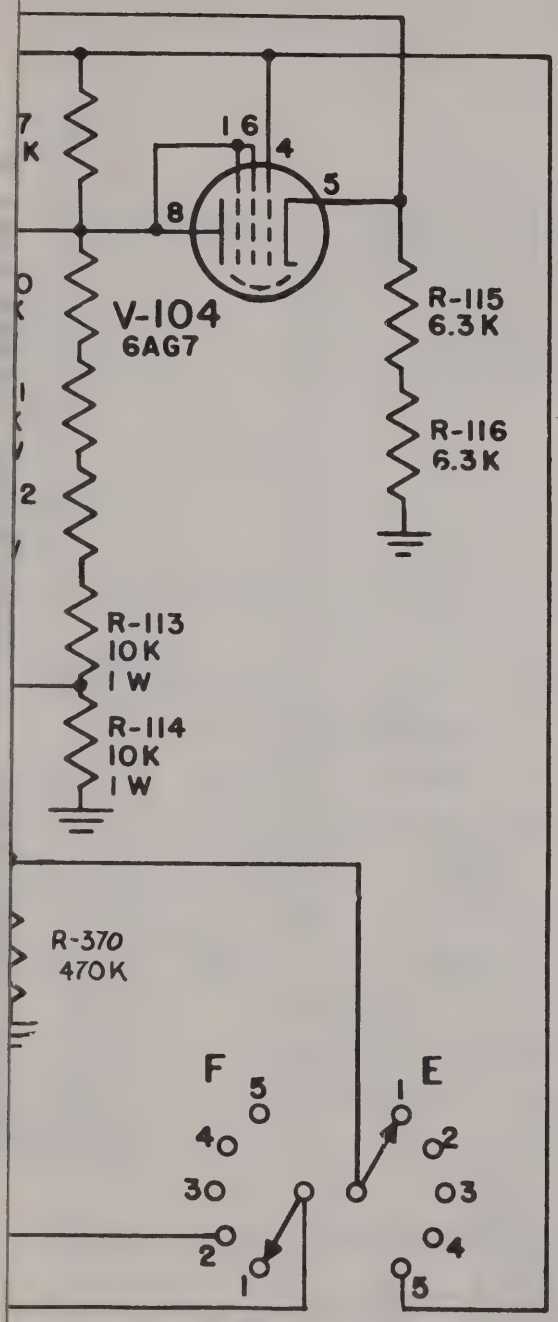
} EXT

PULSE RATE

4. X 1
5. X 10

} INT

Figure 8-12. Signal Generator TS-418B/U, Simplified Schematic of Sync Selector Switch S-302



NOTE:

C IS IN MICRO-MICROFARADS AND R IS IN OHMS UNLESS OTHERWISE INDICATED. K EQUALS THOUSANDS AND MEG EQUALS MILLIONS OF OHMS.

S-303 POSITIONS

1. CW	INT
2. PULSE	INT
3. POS.	EXT
4. NEG.	EXT
5. AM	EXT

Figure 8-13. Signal Generator TS-418B/U, Simplified Schematic of Mod Selector Switch S-303

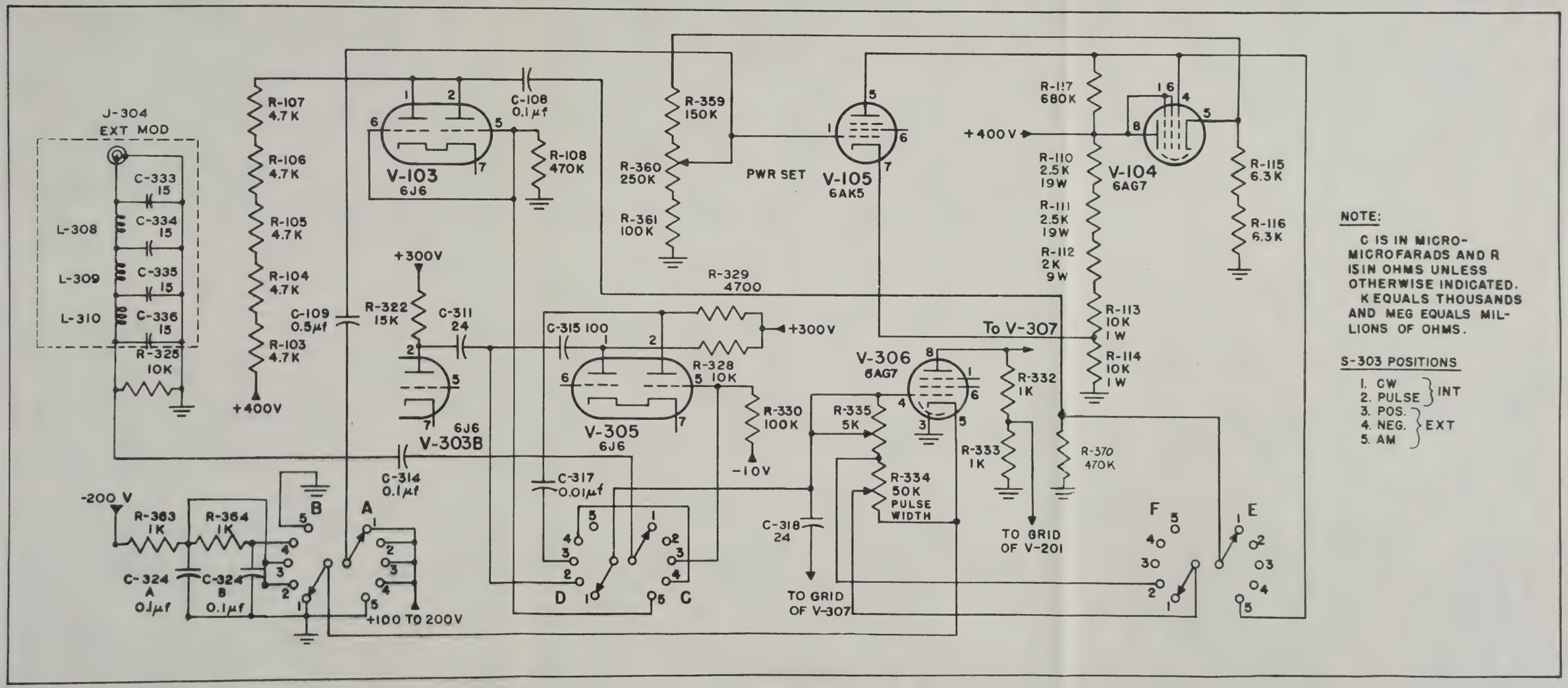
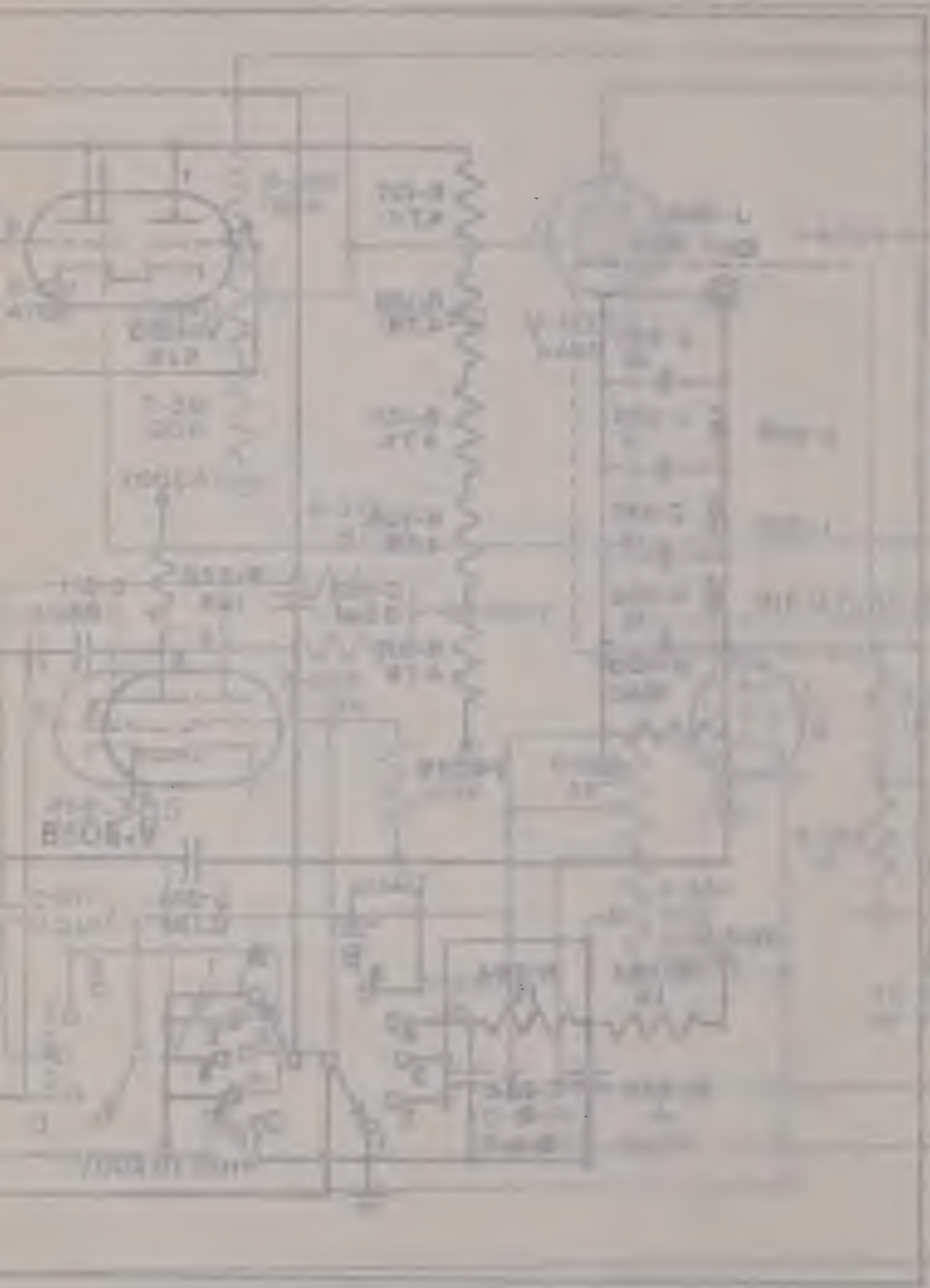


Figure 8-13. Signal Generator TS-418B/U, Simplified Schematic of Mod Selector Switch S-303



CONDITIONS OF MEASUREMENT

1. Waveshapes are shown on a 250 microsecond time base. SYNC OU pulse was used to trigger oscilloscop sweep.

2. Waveshapes were obtained whe Signal Generator TS-418/U was syn chronized with an external 1000 cps 10-volt rms (28-volt peak-to-peak sine wave (SYNC SELECTOR switc set to SINE WAVE position).

3. Pulse voltages shown are peak-t peak voltages. The voltages should regarded as approximations and ma vary at least 20% depending upon ag of tubes, method of measurement, et

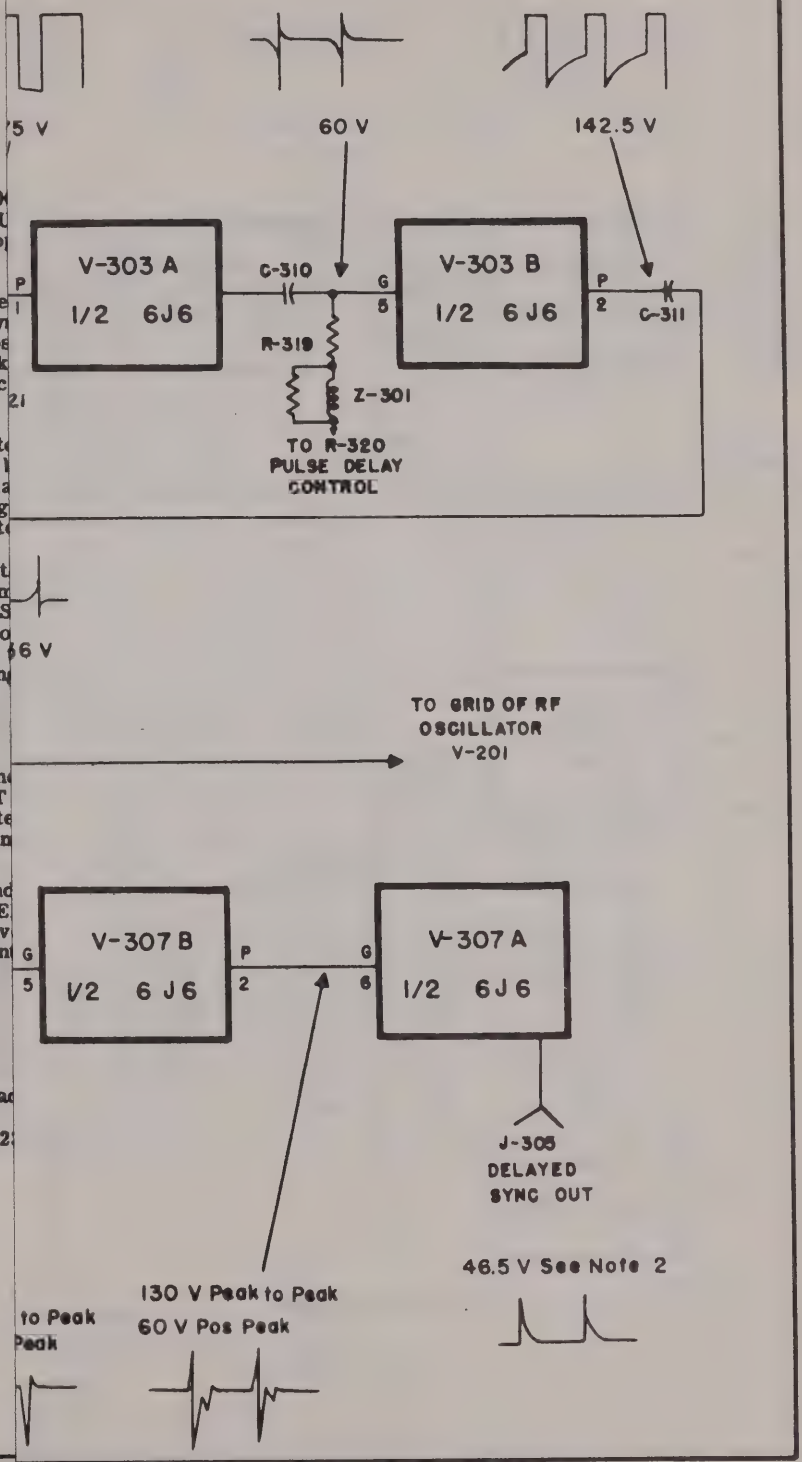
4. Waveshapes were obtained wit PULSE DELAY control set for 100 m croseconds of delay and with PULS WIDTH control set for 10 microseco Waveshapes will vary according pulse repetition frequency and settin controls.

NOTES

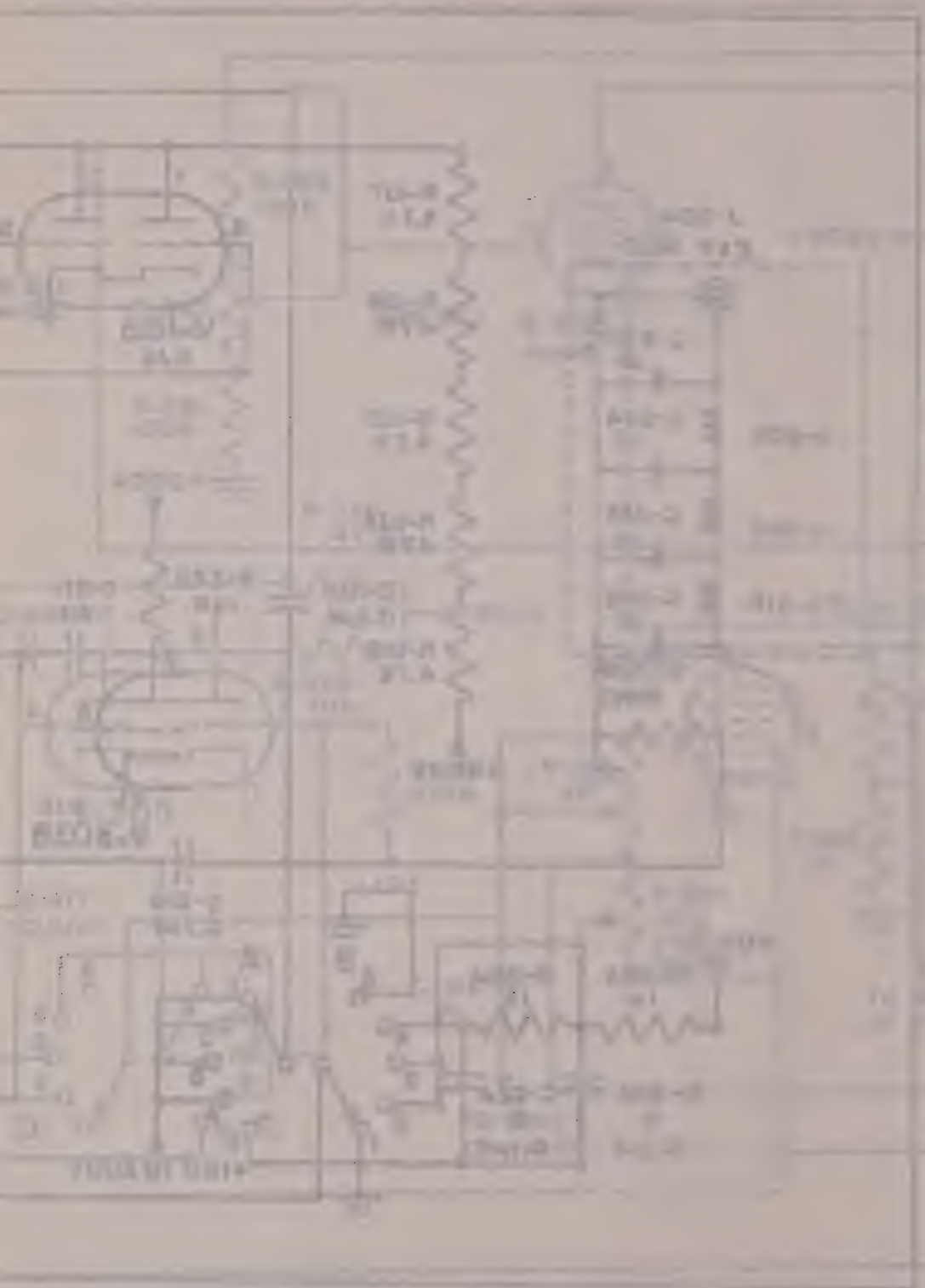
1. Amplitude of this voltage depen upon the load into which SYNC OUT working. Voltage given is for rate load of 500 ohms shunted by 1500 mm

2. Amplitude of this voltage depend upon the load into which DELAYE SYNC OUT is working. Voltage giv is for rated load of 500 ohms shun by 1500 mmf.

Note:
S-302 in position (3)
S-303 in position (2)
J-303 and J-305 without external loa
Pulse width set to Min
Readings taken on Oscilloscope TS-2



ignal Generator TS-418B/U, Servicing Block Diagram



CONDITIONS OF MEASUREMENT

1. Waveshapes are shown on a 2500-microsecond time base. SYNC OUT pulse was used to trigger oscilloscope sweep.

2. Waveshapes were obtained when Signal Generator TS-418/U was synchronized with an external 1000 cps, 10-volt rms (28-volt peak-to-peak) sine wave (SYNC SELECTOR switch set to SINE WAVE position).

3. Pulse voltages shown are peak-to-peak voltages. The voltages should be regarded as approximations and may vary at least 20% depending upon age of tubes, method of measurement, etc.

4. Waveshapes were obtained with PULSE DELAY control set for 100 microseconds of delay and with PULSE WIDTH control set for 10 microseconds. Waveshapes will vary according to pulse repetition frequency and setting of controls.

NOTES

1. Amplitude of this voltage depends upon the load into which SYNC OUT is working. Voltage given is for rated load of 500 ohms shunted by 1500 mmf.

2. Amplitude of this voltage depends upon the load into which DELAYED SYNC OUT is working. Voltage given is for rated load of 500 ohms shunted by 1500 mmf.

Note:
S-302 in position (3)
S-303 in position (2)
J-303 and J-305 without external load
Pulse width set to Min
Readings taken on Oscilloscope TS-239/U

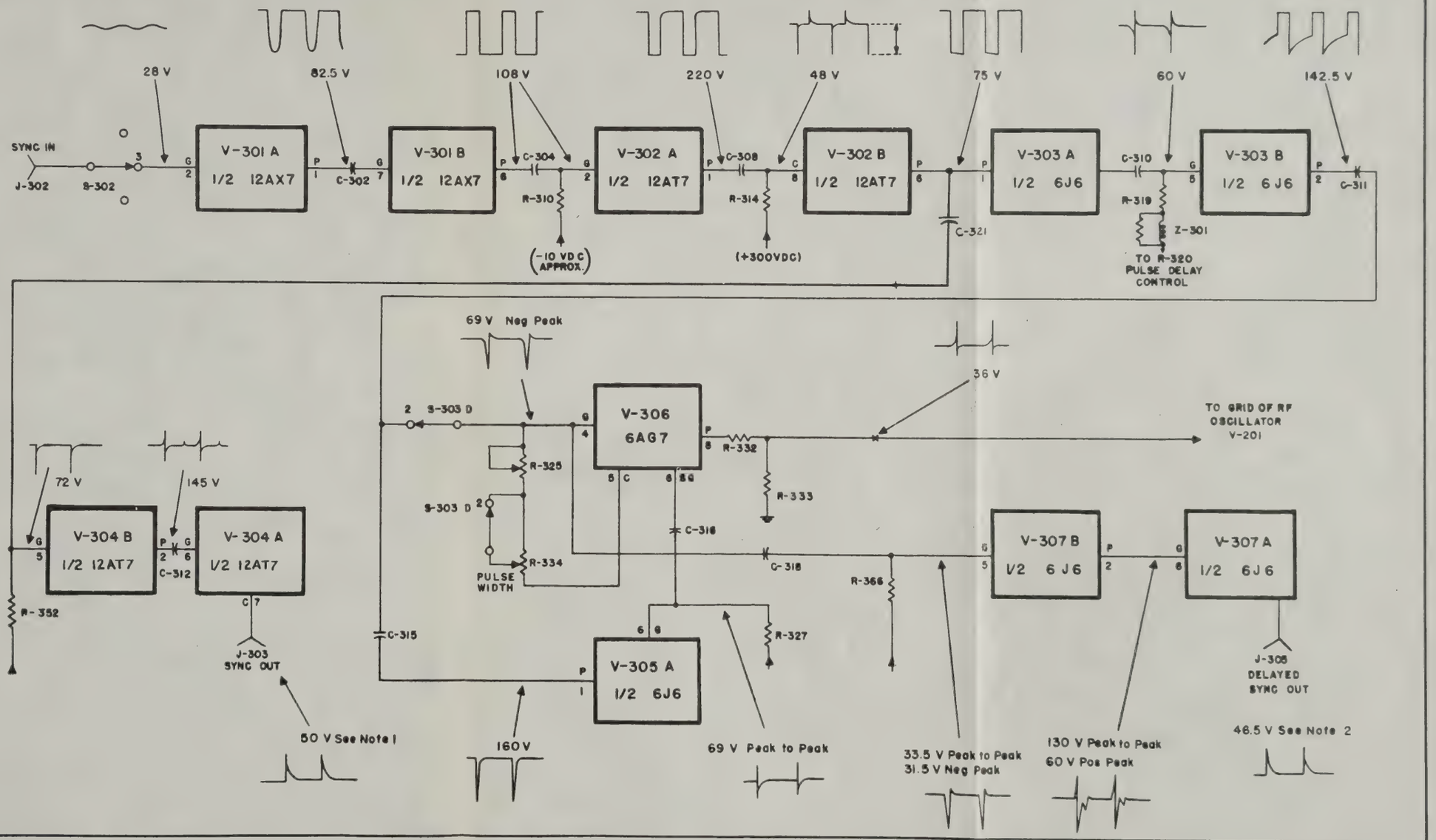
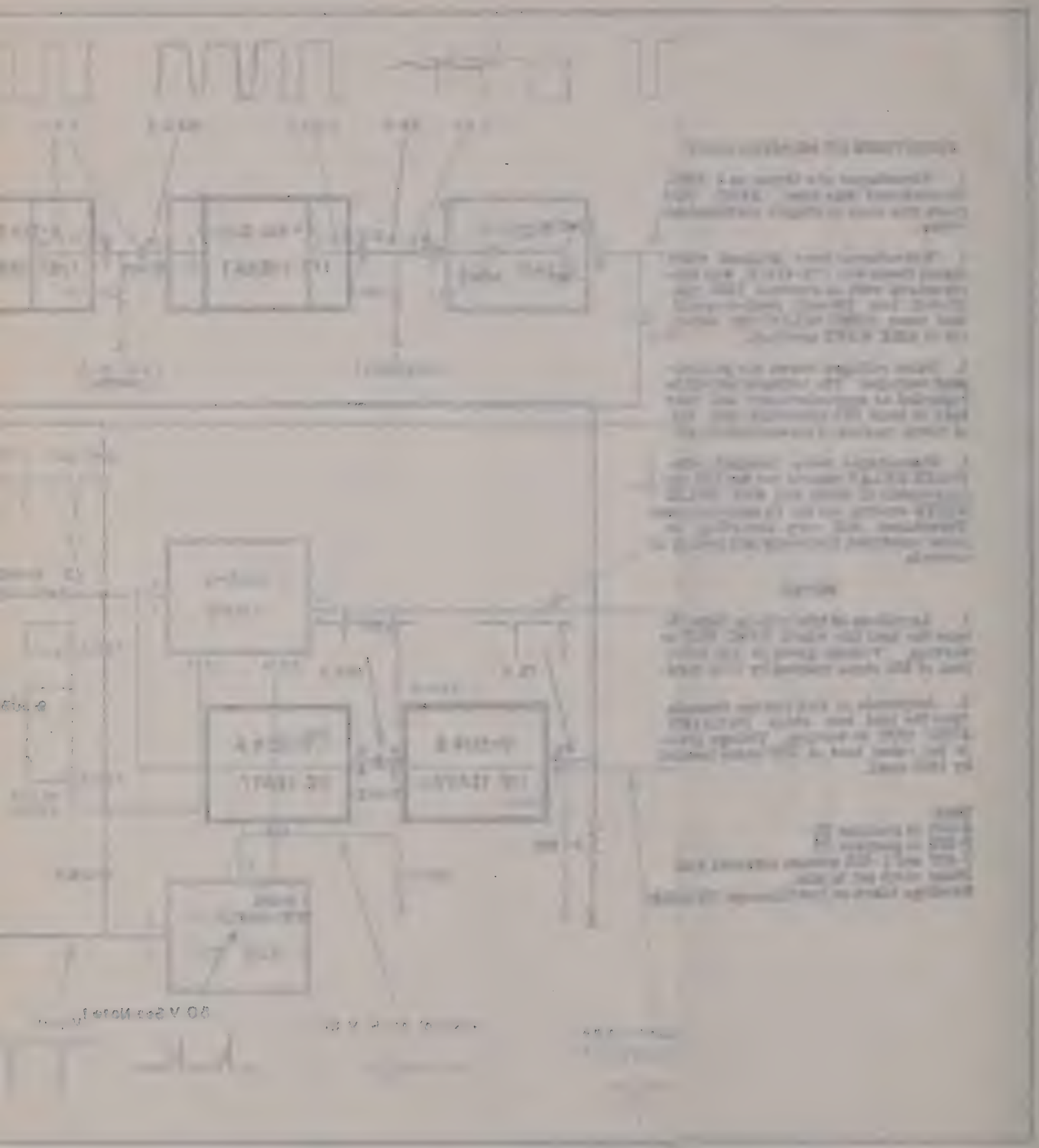


Figure 8-14. Signal Generator TS-418B/U, Servicing Block Diagram



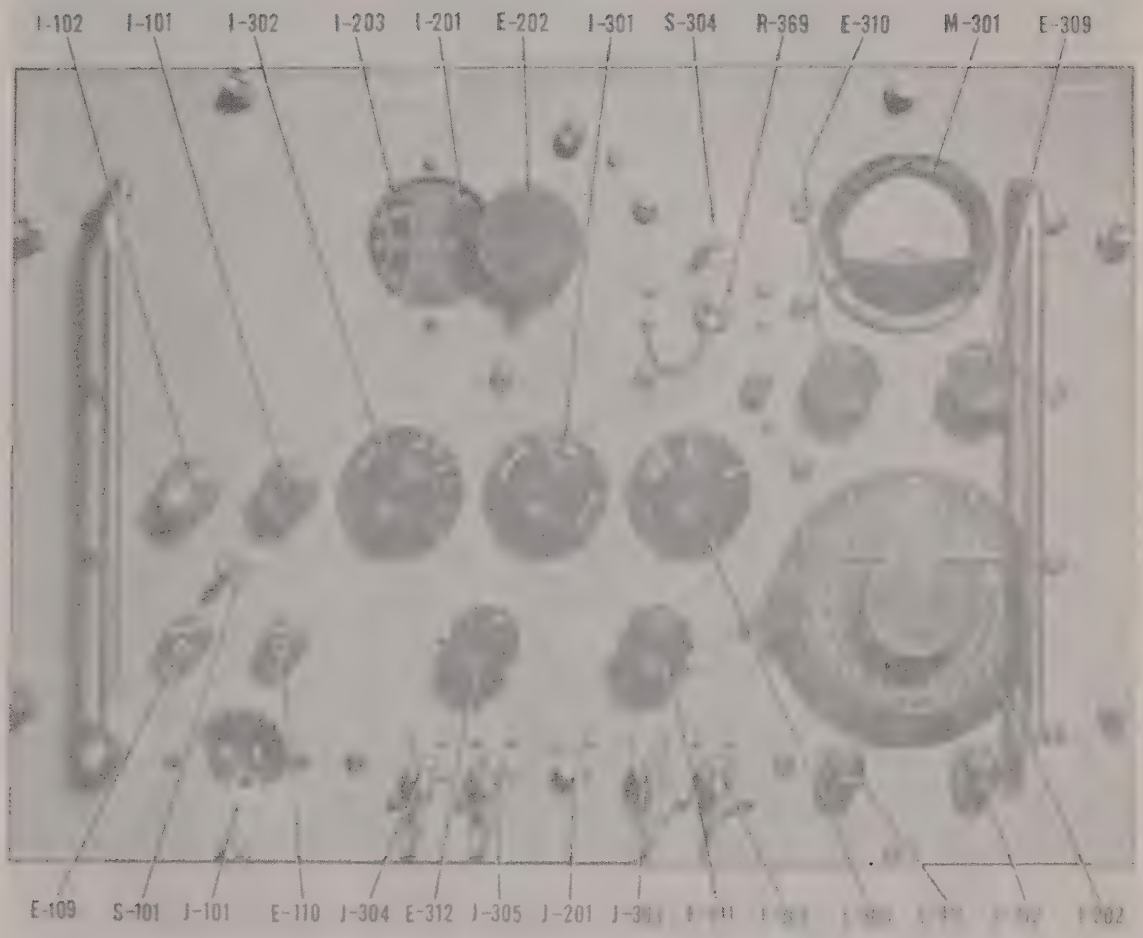


Figure 8-15. Signal Generator TS-418B/U, Front Panel Controls

SECTION VIII

DIFFERENCE DATA SHEETS

These Difference Data Sheets include the Table of Replaceable Parts for TS-418A/U Signal Generator manufactured under Contract N383s-83807. Section I through V and Section VII contain accurate data for the operation and maintenance of the TS-418A/U Signal Generator, Ser. Nos. 1 through 400 as manufactured under Contract N383s-83807.

TABLE 6-1.—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
101-399		GENERATOR, RF signal: Army-Navy Signal Generator TS-418/U; AM and pulse, CW; 400 to 1000 mc in one band; metal case; 17⅝" wd x 12⅜" h x 14 21/32" d o/a; 1% accuracy; internal pulse modulation; can be modulated externally by AM or pulse; output meter calibrated in db; 115 V, 50 to 1600 cps single phase; accessories are Case CY-741/U, 1 ea RF Cable CG-546/U (6'), 2 ea RF Cable CG-546/U (8'), 3 ea Adapter UG-201/U, 3 ea Adapter UG-255/U, 3 ea Adapter UG-273, 1 ea Power Cord CX-337/U (6'), 3 ea Lamps Mazda #47, 3 ea Fuses Bussman 3AG-3 amp, 1 ea Thermistor VECO 27D1; 28D1; 32A3.	Signal source 400 to 1000 mcs for receiver measurements and other applications that require less than 1 milliwatt of CW, amplitude mod; or pulse mod RF signals.	Transitron R-0109-00100	Bureau of Aeronautics specification 16G6 (AER)
101-399		GENERATOR, RF signal: Army-Navy Signal Generator TS-418A/U; AM and pulse, CW; 400 to 1000 mc in one band; metal case; 17⅜" wd x 12⅜" h x 14 21/32" d o/a; 1% accuracy; internal pulse modulation; can be modulated externally by AM or pulse; output meter calibrated in db; 115 V, 50 to 1600 cps single phase; accessories are Case CY-741/U, 1 ea RF Cable CG-546/U (6'), 2 ea RF Cable CG-546/U (8'), 3 ea Adapter UG-201/U, 3 ea Adapter UG-255/U, 3 ea Adapter UG-273, 1 ea Power Cord CX-337/U (6'), 3 ea Lamps Mazda #47, 3 ea Fuses Bussman 3AG-3 amp, 1 ea Thermistor VECO 27D1; 28D1; 32A3; similar to Signal General TS-418/U except for addition of cavity, shield and filters.	Signal source 400 to 1000 mcs for receiver measurements and other applications that require less than 1 milliwatt of CW, amplitude mod; or pulse mod RF signals.	Transitron G-0109-00554	Bureau of Aeronautics specification 16G6 (AER)
		POWER SUPPLY CIRCUIT			
C-101	3300-317094652 R16-C-11493-605 3DB2-74	CAPACITOR, fixed: paper 2 mf ±10%; 1000 vdcw; HS metal case; 4½" h x 1½" diam; oil filled and impr; two solder lug term on end; #¾"-16 mtg stud.	Filter element for +400V supply	JAN CP41B1DG205K	JAN-C-25
C-102		CAPACITOR, fixed: same as C-101	Same as C-101		
C-103	3300-317642959 R16-C-11599-27-5 3DB4-224	CAPACITOR, fixed: paper; 4 mf ±10%; 600 vdcw; HS metal case; 4½" h x 1½" diam; oil filled and impr; two solder lug term on end; #¾"-16 mtg stud.	Same as C-101	JAN CP41B1DF405K	JAN-C-25
C-104		CAPACITOR, fixed: same as C-103	Same as C-101		
C-105		CAPACITOR, fixed: same as C-103	Filter element for +300V supply		
C-106		CAPACITOR, fixed: same as C-103	Filter element for —200V supply		
C-107		CAPACITOR, fixed: same as C-103	Same as C-106		
C-108	3300-316777466 R16-C-11179-30 3DA100-596	CAPACITOR, fixed: paper; 100,000 mmf ±10%; 600 vdcw; HS metal case; 2 1/16" lg x 1 1/16" diam; oil filled and impr two axial wire leads; single hole mtg clamp.	Couples V-103 video amplifier plate to grid of V-104	JAN CP28A1EF104K	JAN-C-25

TABLE 6-1—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
C-109	3300-319001041 R16-C-11354-24 3DA500-468	CAPACITOR, fixed: paper; 500,000 mmf ±10%; 600 vdcw; 1 13/16" lg x 1" wd x 7/8" thk; HS metal case; oil filled and impr; two solder lug term located on side; two 3/16" diam mtg holes on 2 1/8" mtg ctr	Couples ripple voltage to grid of V-105 Prevents change in potentials of grid of V-105	JAN CP53B1FF504K	JAN-C-25
E-101		BOARD #6, terminal: resistor binding post strip; 12 pr solder lug term, brass, silver; 9 pr on 1 7/8" centers; 3 pr on 1 3/8" centers; bakelite; 5 1/4" lg x 2 1/2" wd x 1/8" thk; two .147 diam mtg holes on 3 1/8" mtg/c	To support circuit components R-101, R-103, R-104, R-105, R-106, R-107, R-108, R-109, R-113, R-114, R-117, R-118	Transitron B-0109-00449	Transitron B-0109-00449
E-102		BOARD #7, terminal: resistor binding post strip; six solder lug term, brass, silver pl; two pr on 3 1/2" centers, one pr on 2 1/2" centers; bakelite; 4 1/4" lg x 2 1/2" wd x 1/8" thk; two .120 diam mtg holes on 3 1/2" x 7/8" centers; bakelite plate 1/32" thk mtd on back	To support circuit components R-110, R-111, R-112	Transitron B-0109-00452	Transitron B-0109-00452
E-103		BOARD #8, terminal: resistor binding post strip; six solder lug term, brass, silver pl; three pr on 2 1/2" centers; bakelite; 3 1/4" lg x 2 1/2" wd x 1/8" thk; two .120 diam mtg holes on 1 3/4" x 7/8" centers; bakelite plate 1/32" thk mtd on back	To support circuit components R-102, R-115, R-116	Transitron B-0109-00460	Transitron B-0109-00460
E-104	3300-295580677 R16-S-3934 2Z8320-13	SHIELD, tube: aluminum; cylindrical; twist lock mtg; .941" diam x 1 3/4" h	Tube shield for V-103	JAN S0S6	JAN-S-28
E-105	3300-295578675 R16-S3932-800 2Z8304.57	SHIELD, tube: aluminum; cylindrical; twist lock mtg; .941" diam x 1 3/8" h	Shield for V-105	JAN S0S3	JAN-S-28
E-106	3300-295578954 R16-S-3934-5 3Z8304.131	SHIELD, tube: aluminum; cylindrical; twist lock mtg; .941" diam x 2 1/4" h; steel cad plated	Shield for V-106	Eby 8694	
E-107	8800-444200 17-L-6305 2Z5927	LAMP, incandescent: Army-Navy Type #TB-11, 6-8 v, 0.25 amp; T 3 1/4 clear bulb; 1 1/8" lg; miniature bayonet base; C-2R tungsten fil; burn any position	Indicates heaters on	Mazda 44	
E-108	8800-4441663 17-L-6297 2Z5952	LAMP, incandescent: Army-Navy Type #TB-14; 6-8 v, 0.15 amp; T 3 1/4 clear bulb; 1 1/8" lg; miniature bayonet base; C-2R tung fil; burn any position	Indicates power on	Mazda 47	
E-109	8800-619655 R17-P-7194-50	HOLDER, fuse: extractor post type; for one 3AG fuse; black bakelite body; 250 V, 15 amp max; 1 1/16" diam x 2" lg; 1/4-24 thd body for panel mtg; 2 solder lug term	For fuse F-101	Bussman HKP-H	
E-110		HOLDER, fuse; same as E-109	For F-102		
E-111		HOLDER, fuse; same as E-109	For F-103		
E-112		HOLDER, fuse; same as E-109	For F-104		

E-113		BOARD #5, terminal: resistor binding post strip; four solder lug term; brass, silver; two pr at 3½" centers; bakelite; 4¼" lg x 2" wd x⅛" thk; three .147" diam mtg holes on 1⅛" centers; two outside holes csk	To support circuit components R-119, R-120	Transitron B-0109-00444	Transitron B-0109-00444
F-101	8800-361212 R17-F-16310 3Z1950	FUSE, cartridge: Sig C FU-50; 3 amp, indefinite blowing time at 110% load, 1 hr blowing time at 135% load, 2 min blowing time at 200% load; 250 V; one time; glass body; ferrule term; ¼" lg x ¼" diam	3 amp AC line fuse	Bussman 3AG-3 Amp	
F-102		FUSE, cartridge: same as F-101	Same as F-101		
F-103		FUSE, cartridge: same as F-101	Spare fuse		
F-104		FUSE, cartridge: same as F-101	Spare fuse		
I-101	8800-529142-5 R17-L-12930-77	LIGHT, indicator: w/lens; ½" diam white frosted lens; T-3¼ bulb; encl shell; brass shell, black lacquer finish; 2⅜" lg x ⅞" diam; $1\frac{1}{16}$" diam mtg hole; horiz mtd, lamp replaceable from front; threaded jewel; two solder lug term on end; mechanical dimmer	For lamp E-107	Dialco 832210-117	
I-102	8800-529202-685 R17-L-12930-76	LIGHT, indicator: w/lens; ½" diam red frosted lens; T-3¼ bulb; encl shell; brass shell, black lacquer finish; 2⅜" lg x ⅞" diam; $1\frac{1}{16}$" diam mtg hole; horiz mtd, lamp replaceable from front; threaded jewel; two solder lug term on end; mechanical dimmer	For lamp E-108	Dialco 832210-111	
J-101	8850-494340 R17-R-2029-20	CONNECTOR, receptacle: two flat parallel blades; straight type; 1¼" lg x 1½" d; black molded bakelite body; two .156" mtg holes on 1.937" mtg/c	Connects to P-101	Hubbell 4891	
L-101A L-101B		REACTOR; filter choke; dual; Sect #1, 10 hy, 125 ma, Sect #2, 10 hy, 75 ma; Sect #1, 160 ohms DC resistance at 25°C, Sect #2, 265 ohms DC resistance at 25°C; 600 V RMS test; HS metal case; 5½" h x $3\frac{9}{16}$" wd x 2⅞" thk, o/a; four #10-32 x ½" spade bolts on 2½" mtg/c; four solder lug term on standoff ins 1¼" c to c on top of case	Filter element for −200V supply Filter element for +400V supply	Transitron B-0109-00509	Transitron B-0109-00509
O-101	3300-287172845 R16-C-19582 2Z2636-26	CLIP: tube retaining; for holding tube in place; SS; $1\frac{5}{16}$" diam x ⅞" h; $1\frac{7}{16}$" diam max opening; incl mtg bracket w/elongated hole for #10 mtg screw	Lock for tube V-102	Birtcher 926 C	
O-102	3300-291697089 R-16-C-19628 2Z5042-4	CLIP: tube retaining for holding tube in place; SS; $1\frac{3}{16}$" diam x ⅞" h; $1\frac{5}{16}$" diam max opening; incl mtg bracket w/elongated hole for #10 mtg screw	Lock for tube V-101	Birtcher 926 B	
O-103		RETAINER, tube: same as O-101	Lock for V-104		
O-104	8800-117830 R17-C-2665	CAP: fuseholder cap; p/o Bussman Fuseholder HKP-H; black molded phenolic; ¾" lg x $1\frac{1}{16}$" diam; twist lock type mtg; marked "Fuse" and w/counter clockwise arrow; rubber gasket ⅛" OD x ⅜" ID; hole for test prod in ctr of cap	Cover for E-109	Bussman HKP-H9758[1]	
O-105		CAP. fuseholder: same as O-104	Cover for E-110		
O-106		CAP. fuseholder: same as O-104	Cover for E-111		
O-107		CAP. fuseholder: same as O-104	Cover for E-112		

TABLE 6-1—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
R-101	3300-381367200 R16-R-17349-15-500 3RC31BF154K	RESISTOR, fixed: comp; 150,000 ohms ±10%; 1 w; 1.28" lg x .310" diam; two axial wire leads	Bleeder for —200V supply	JAN RC31BF154K	JAN-R-11
R-102	3300-385291090 R16-R-18681-14-250 3RW29109	RESISTOR, fixed: ww; 6300 ohms ±5%; 9 w; 2" lg x ½" diam; ins; inductive; two solder lug term	Filter element for +300V supply	JAN RW51J632	JAN-R-26
R-103		RESISTOR, fixed: comp; 4700 ohms ±10%; 2 w; 1.78" lg x .405" diam; two axial wire leads	Load resistor for V-103	JAN RC40BF472K	JAN-R-11
R-104		RESISTOR, fixed: same as R-103	Same as R-103		
R-105		RESISTOR, fixed: same as R-103	Same as R-103		
R-106		RESISTOR, fixed: same as R-103	Same as R-103		
R-107		RESISTOR, fixed: same as R-103	Same as R-103		
R-108	3300-381219860 R16-R-17354-14-202 3RC21BF474K	RESISTOR, fixed: comp; 470,000 ohms ±10%; ½ w; .655" lg x .249" diam; two axial wire leads	Grid resistor for V-103	JAN RC21BF474K	JAN-R-11
R-109	3300-381218000 R16-R-17262-55-53 3RC21BF221K	RESISTOR, fixed: comp; 220 ohms ±10%; ½ w; .655" lg x .249" diam; two axial wire leads	Provides Grid cathode bias	JAN RC21BF221K	JAN-R-11
R-110	3300-385267490 R16-R-18675-655 3RW26749	RESISTOR, fixed: ww; 2500 ohms ±5%; 19 w; 2⅞" lg x $^{19}/_{32}$" diam; ins; inductive; two solder lug term	Determines potential of V-105	JAN RW52J252	JAN-R-26
R-111		RESISTOR, fixed: same as R-110	Same as R-110		
R-112	3300-385261390 R16-R-18663-90 3RW26139	RESISTOR, fixed: ww; 2000 ohms ±5%; 9 w; 3" lg x ⅛" diam; ins; inductive; two solder lug term	Dropping resistor for V-106	JAN RW51J202	JAN-R-26
R-113	3300-381366160 R16-R-17310-8 3RC31BF103K	RESISTOR, fixed: comp; 10,000 ohms ±10%; 1 w; 1.28" lg x .310" diam; two axial wire leads	Determines cathode voltage of V-105	JAN RC31BF103K	JAN-R-11
R-114		RESISTOR, fixed: same as R-113	Same as R-113		
R-115		RESISTOR, fixed: same as R-102	Bleeder for regulated supply		
R-116		RESISTOR, fixed: same as R-102	Same as R-115		
R-117	3300-381220700 R16-R-17364-5 3RC21BF684K	RESISTOR, fixed: comp; 680,000 ohms ±10%; ½ w; .655" lg x .249" diam; two axial wire leads	Maintains grid potential of V-104	JAN RC21BF684K	JAN-R-11

R-118	3300-385279140 R16-R-18679-20-250 3RW27914	RESISTOR, fixed: ww; 4000 ohms ±5%; 5 w; 2 5/16" lg x 5/8" diam; ins; inductive; two solder lug term	Provides voltage regulation with V-107	JAN RW50J402	JAN-R-26
R-119	3300-385249090 R16-R-18658-274 3RW24909	RESISTOR, fixed: ww; 1200 ohms ±5%; 19 w; 2 7/8" lg x 1 9/32" diam; ins; inductive; two solder lug term	Standby Heater	JAN RW52J122	JAN-R-26
R-120		RESISTOR, fixed: same as R-119	Standby Heater		
S-101		SWITCH, toggle: DPDT; JAN-ST22N; 3 amp 125 V; bakelite body; 1 9/32" lg x 2 3/32" wd x 2 3/32" h; bat handle 1 1/16" lg; locking action, normally closed; solder lug term; mtg bushing 15/32" lg x 15/32"-32 thd diam; JAN spec JAN-S-23	Power on-off Switch	JAN ST22N	JAN-S-23
T-101		TRANSFORMER, power: plate and filament type; input 115 V, 50-1600 cyc, single phase; 7 output windings secd #1, 2 and 3, 6.3 V at .65 A; secd #4 and 7, 5 V at 2 A; secd #5, 285 V AC, CT at 75 ma; secd #6, 405 V, AC, CT at 125 ma; HS metal case; 4 3/8" lg x 4 3/8" wd x 5 1/2" h; 18 solder lug term on bottom; four 1/2-20 NC-2 thd mtg stud, 3 7/16" x 2 7/8" mtg/c	Furnishes all filament and B voltages	Transitron C-0109-00510	Transitron C-0109-00510
V-101	3300-234390000 16-T-55735 2J5Y3GT	TUBE, electron: rectifier	Rectifier for —200V supply	JAN 5Y3GT	JAN-1A
V-102	3300-234355000 16-T-55444 2J5R4GY	TUBE, electron: rectifier	Rectifier for +400 volt	JAN 5R4GY	JAN-1A
V-103	3300-234560000 16-T-56360 2J6J6	TUBE, electron: miniature dual triode w/single cathode	Video amplifier for external sine modulation	JAN 6J6	JAN-1A
V-104	3300-234445000 16-T-56177 2J6AG7	TUBE, electron: pentode	Dropping tube in +100 to +240 V voltage regulator	JAN 6AG7	JAN-1A
V-105	3300-234450000 16-T-56191 2J6AK5	TUBE, electron: miniature pent	Control tube in +100 to +240 V voltage regulator	JAN 6AK5	JAN-1A
V-106	3300-234006000 16-T-52001-05 2J0B2	TUBE, electron: miniature voltage regulator	Regulates voltage on V-105 and DC supply voltage for monitor bridge	JAN 0B2	JAN-1A
V-107		TUBE, electron: same as V-106	Regulates DC voltage of V-302A and V-305		
X-101		SOCKET, tube: octal base; ceramic body; steel saddle, tinned; 1 25/32" x 1 1/4" x 1 1/16"; two 1/8" mtg holes 1 1/2" apart	Socket for V-101	JAN TS101C01	JAN-S-28
X-102		SOCKET, tube: same as X-101	Socket for V-102		
X-103		SOCKET, tube: miniature 7 prong; ceramic, 1 3/16" x 1 1/16" x 3/4"; two 1/8" mtg holes 7/8" apart o/a	Socket for V-103	JAN TS102C01	JAN-S-28
X-104		SOCKET, tube: same as X-101	Socket for V-104		
X-105		SOCKET, tube: same as X-103	Socket for V-105		

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TABLE 6-1—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
X-106		SOCKET, tube: same as X-103	Socket for V-106		
X-107		SOCKET, tube: same as X-103	Socket for V-107		
		RF OSCILLATOR CIRCUIT			
A-201		HOUSING: Cavity End Housing; P/O Army-Navy Signal Generator TS-418/U; Housing Transitron B-0109-00190; 5 1/8" lg x 2 5/8" diam; eight 5/32" diam mtg holes 45° apart	Cavity and housing	Transitron B-0109-00190	Transitron B-0109-00190
A-202		RAIL, guide: cavity carriage guide; P/O Army-Navy Signal Generator TS-418/U; 5.53125" lg x .187" diam; mts by 6-32 thd .375" lg at end	Cavity carriage guide	Transitron A-0109-00341	Transitron A-0109-00341
A-203		BLOCK, support: Cavity support block; P/O Army-Navy Signal Generator TS-418/U; brass, rhodium pl; 2 7/8" lg x 2 3/4" wd x 3/4" thk	Cavity support block	Transitron B-0109-00215	Transitron B-0109-00215
A-204		COVER: p/o Army-Navy Signal Generator TS-418A/U; cad pl brass, gray enamel; 1 49/64" lg x 1 21/32" wd x 5/8" h o/a; eight 0.120" diam mtg holes, located two on ea side 29/32" c to c	Cover for twin filter part of cavity shield	Transitron B-0109-00228	Transitron B-0109-00228
A-205		COVER: p/o Army-Navy Signal Generator TS-418A/U; cad pl brass, gray enamel; 13 11/32" lg x 2 31/32" wd x 1/32" thk o/a; seventeen 0.063" diam mtg holes irregularly spaced	Top cover for cavity shield	Transitron B-0109-00227	Transitron B-0109-00227
A-206		HOUSING: p/o Army-Navy Signal Generator TS-418A/U; cad pl brass, gray enamel; irregularly shaped; 15 3/8" lg x 6 1/2" wd x 3" thk; twenty-three 0.120" diam mtg holes irregularly spaced	Part of cavity shield	Transitron D-0109-00179	Transitron D-0109-00179
A-207		HOUSING: p/o Army-Navy Signal Generator TS-418A/U; cad pl brass, exposed surfaces gray enamel; irregularly shaped; 13 11/32" lg x 6 1/2" wd x 2 31/32" thk; fifteen 0.063" diam mtg holes irregularly spaced	Part of cavity shield	Transitron D-0109-00185	Transitron D-0109-00185
E-201	3300-292241249 R16-K-3344-250 2Z5822-88	KNOB: fluted; black phenolic; for 1/4" diam shaft; two #10-32 Allen head cup pt set screw 90° apart; 1 1/8" diam x 3/4" h o/a; brass insert; shaft hole 1/2" d	Adjusts attenuation of RF signal output	Kurz-Kasch S-309-64-B-BB	
E-202		KNOB: fluted; black phenolic for 1/4" diam shaft; two #6-32 set screws at 90° angle; 1 1/8" diam x 3/4" h o/a; brass insert; shaft hole 1/2" deep	Adjusts freq of RF output signal	Kurz-Kasch S-309-6464BB-BF-1889B	Kurz-Kasch S-309-6464BB-BF-1889B

E-203C		INSULATOR, plate: rectangular; mica; 1.250" lg; .875" wd, .010" thk; 4.116" diam mtg holes on 1.000" x .625" mtg/c p/o Army-Navy Signal Generator TS-418/U	Insulates thermistor from mtg block	Transitron A-0109-00312	Transitron A-0109-00312
E-203D		INSULATOR, standoff: round post shape; phenolic w/steel stud in one end, term in other end; 1 1/16" lg; .203" diam; mts by #4-40 stud; stud rhodium pl; p/o Army-Navy Signal Generator TS-418/U	Term for lead of Resistor R-349	Garde Mfg. 3449-27	
E-203E		INSULATOR, standoff: Same as E-203D	Term for lead of Resistor R-355		
E-203F		BRACKET: filter support; "L" shape, brass, rhodium pl; 1.437" lg x 1.000" wd x 1.000" d; two .147" diam mtg holes on .500" mtg/c; p/o Army-Navy Signal Generator TS-418/U	Filter support	Transitron A-0009-00320	Transitron A-0009-00320
E-203G		INSULATOR, disc: round; textolite; .250" h; 1.875" OD w/four .094" diam mtg holes 90 deg apart; p/o Army-Navy Signal Generator TS-418/U	Insulator for V-201	Transitron A-0109-00345	Transitron A-0109-00345
E-203H		INSULATOR, disc: round; mica, 1 15/16" diam x .010" thk, four .094" diam mtg holes 90 deg apart; p/o Army-Navy Signal Generator TS-418/U	Insulator for O-206	Transitron A-0109-00344	Transitron A-0109-00344
E-203J		BRUSH, electrical cont tube grid cont; brass rhodium pl; cylindrical .870" diam x .563" lg; four .070" diam mtg holes on OD 90° apart; straight cont end; p/o Signal Generator TS-418/U	Grid contact	Transitron A-0109-00329	Transitron A-0109-00329
E-203		CAVITY, tuned: 400 to 1000 mc; 1 mw into 50 ohms resistive; manual tuning; approx 16" lg x 8 3/4" h x 5 3/4" d o/a; has RF shield; 1/4 wave resonant line; receives power from electronic voltage regulator in power circuit; mounts to front panel by six (6) irregularly located spacers each with #10-32 internal thread; p/o Signal Generator TS-418A/U	Provides a 400 - 1000 mc signal at a max power of 1 mw	Transitron D-0109-00100-C	Transitron D-0109-00100-C
H-201	6600-324382 R33-G-1712	GROMMET: black rubber, 1 1/16" OD x 1/2" x 5/16" thk; 1/16" groove	Protects Z-202 from vibration and shock	Atlan India Rub 2283	
H-202A		STUD: brass, rhodium pl; .406" lg; one end w/#4-40 thd, .156" lg; p/o Army-Navy Signal Generator TS-418/U	Tube retainer stud	Transitron A-0109-00301	Transitron A-0109-00301
H-202B		WASHER, lock: phosphor bronze rhodium pl; round OD .250" hole diam, .133" x .016" thk; shakeproof; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Transitron A-0109-00336	Transitron A-0109-00336
H-202C		STUD: same as H-202A	Same as H-202A		

TABLE 6-1—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
H-203A		SCREW, machine: slot drive; bind H; brass, rhodium pl; #4-40; ¼" lg; ¼"thd; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Transitron A-0109-00542-1	Transitron A-0109-00542-1
H-203B		WASHER, lock: phosphor bronze rhodium pl; round .120" ID, .260" OD x .016" thk; shakeproof type, int teeth; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Transitron A-0109-00340	Transitron A-0109-00340
H-203C		SCREW, machine: same as H-203A	Same as H-203A		
H-203D		WASHER, lock: same as H-203B	Same as H-203B		
H-203E		SCREW, machine: same as H-203A	Same as H-203A		
H-203F		WASHER, lock: same as H-203B	Same as H-203B		
H-203G		SCREW, machine: same as H-203A	Same as H-203A		
H-203H		WASHER, lock: same as H-203B	Same as H-203B		
H-204A		SCREW, machine: same as H-203A	Same as H-203A		
H-204B		WASHER, lock: same as H-203B	Same as H-203B		
H-204C		SCREW, machine: same as H-203A	Same as H-203A		
H-204D		WASHER, lock: same as H-203B	Same as H-203B		
H-205A		SCREW, machine: slot drive; bind H; brass, rhodium pl; #4-40; 3/16" lg; 3/16" lg thd; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Transitron A-0109-00542-2	Transitron A-0109-00542-2
H-205B		WASHER, lock: same as H-203B	Same as H-203B		
H-205C		SCREW, machine: same as H-205A	Same as H-205A		
H-205D		WASHER, lock: same as H-203B	Same as H-203B		
H-205E		SCREW, machine: same as H-205A	Same as H-205A		
H-205F		WASHER, lock: same as H-203B	Same as H-203B		
H-205G		SCREW, machine: same as H-205A	Same as H-205A		
H-205H		WASHER, lock: same as H-203B	Same as H-203B		
H-206A		SCREW, machine: same as H-205A	Same as H-205A		
H-206B		WASHER, lock: same as H-203B	Same as H-203B		
H-206C		SCREW, machine: same as H-205A	Same as H-205A		
H-206D		WASHER, lock: same as H-203B	Same as H-203B		
H-206E		SCREW, machine: same as H-205A	Same as H-205A		
H-206F		WASHER, lock: same as H-203B	Same as H-203B		
H-206G		SCREW, machine: same as H-205A	Same as H-205A		
H-206H		WASHER, lock: same as H-203B	Same as H-203B		

H-207A		SCREW, machine: same as H-205A	Same as H-205A		
H-207B		WASHER, lock: same as H-203B	Same as H-203B		
H-207C		SCREW, machine: same as H-205A	Same as H-205A		
H-207D		WASHER, lock: same as H-203B	Same as H-203B		
H-207E		SCREW, machine: same as H-205A	Same as H-205A		
H-207F		WASHER, lock: same as H-203B	Same as H-203B		
H-207G		SCREW, machine: same as H-205A	Same as H-205A		
H-207H		WASHER, lock: same as H-203B	Same as H-203B		
H-208		SCREW, machine: slot drive; Fil H; brass, rhodium pl; #10-32; 1½" lg; 1½" thd; p/o Army-Navy Signal Generator TS-418/U	Feedback adjustment screw	Transitron A-0109-00335	Transitron A-0109-00335
H-209		NUT: hex; brass, rhodium pl; #10-32 thd; 3/16" thk; p/o Army-Navy Signal Generator TS-418/U	Nut for H-208	Transitron A-0109-00334	Transitron A-0109-00334
H-210A		SCREW, machine: slot drive; bind H; brass, rhodium pl; #6-32; 3/16" lg; 3/16" lg thd; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Transitron A-0109-00541-1	Transitron A-0109-00541-1
H-210B		WASHER, lock: phosphor bronze rhodium pl; round .146" ID, .280" OD x .018" thk; shakeproof type, int teeth, p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Transitron A-0109-00337	Transitron A-0109-00337
H-210C		SCREW, machine: same as H-210A	Same as H-210A		
H-210D		WASHER, lock: same as H-210B	Same as H-210B		
H-211A		SCREW, machine: same as H-210A	Same as H-210A		
H-211B		WASHER, lock: same as H-210B	Same as H-210B		
H-211C		SCREW, machine: same as H-210A	Same as H-210A		
H-211D		WASHER, lock: same as H-210B	Same as H-210B		
H-212A		SCREW, machine: same as H-210A	Same as H-210A		
H-212B		WASHER, lock: same as H-210B	Same as H-210B		
H-213		SCREW, adjustment: brass, rhodium pl; adjusts alignment of attenuator; p/o Army-Navy Signal Generator TS-418/U	Adjusts alignment of attenuator	Transitron A-0109-00274	Transitron A-0109-00274
H-214A		SCREW, machine: slot drive; RH; brass rhodium pl; #2-56; ½" lg; ½" lg thd; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Transitron A-0109-00540	Transitron A-0109-00540
H-214B		SCREW, machine: same as H-214A	Same as H-214A		
H-214C		SCREW, machine: same as H-214A	Same as H-214A		
H-214D		SCREW, machine: same as H-214A	Same as H-214A		
H-215A		SCREW, machine: slot drive; bind H; brass rhodium pl; #2-56 thd; 1/8" lg; 1/8" lg thd; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Transitron A-0109-00338	Transitron A-0109-00338
H-215B		WASHER, lock: phosphor bronze rhodium pl; round .092" ID .180" OD x .012" thk; shakeproof type, int tooth; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Transitron A-0109-00209	Transitron A-0109-00209

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TABLE 6-1—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
H-215C		SCREW, machine: same as H-215A	Same as H-215A		
H-215-D		WASHER, lock: same as H-215B	Same as H-215B		
H-216A		SCREW, machine: slot drive; bind H; brass rhodium pl; #6-32 ½" lg; ½" thd; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Transitron A-0109-00541-2	Transitron A-0109-00541-2
H-216B		WASHER, lock: same as H-210B	Same as H-210B		
H-216C		SCREW, machine: same as H-216A	Same as H-216A		
H-216D		WASHER, lock: same as H-210B	Same as H-210B		
H-217B		WASHER, lock: phosphor bronze rhodium pl; round .200" ID, .376" OD x .22" thk; shakeproof type, int tooth; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Transitron A-0109-00539	Transitron A-0109-00539
H-218A		SCREW, machine: slot drive; bind H; brass rhodium pl; #6-32; ⅜" lg; ⅜" lg thd; p/o Army-Navy Generator TS-418/U	Cavity hardware	Transitron A-0109-00541-3	Transitron A-0109-00541-3
H-218B		WASHER, lock: same as H-210B	Same as H-210B		
H-219A		SCREW, machine: slot drive; RH; brass, rhodium pl; #6-32; 5/16" lg; 5/16" lg thd; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Transitron A-0109-00538-1	Transitron A-0109-00538-1
H-219B		WASHER, lock: same as H-210B	Same as H-210B		
H-219C		SCREW, machine: same as H-219A	Same as H-219A		
H-219D		WASHER, lock: same as H-210B	Same as H-210B		
H-219E		SCREW, machine: same as H-219A	Same as H-219A		
H-219F		WASHER, lock: same as H-210B	Same as H-210B		
H-219G		SCREW, machine: same as H-219A	Same as H-219A		
H-219H		WASHER, lock: same as H-210B	Same as H-210B		
H-219I		SCREW, machine: same as H-219A	Same as H-219A		
H-219J		WASHER, lock: same as H-210B	Same as H-210B		
H-219K		SCREW, machine: same as H-219A	Same as H-219A		
H-219L		WASHER, lock: same as H-210B	Same as H-210B		
H-219M		SCREW, machine: same as H-219A	Same as H-219A		
H-219N		WASHER, lock: same as H-210B	Same as H-210B		
H-220A		SCREW, machine: same as H-219A	Same as H-219A		
H-220-B		WASHER, lock: same as H-210B	Same as H-210B		

H-220C		SCREW, machine: same as H-219A	Same as H-219A		
H-220D		WASHER, lock: same as H-210B	Same as H-210B		
H-220E		SCREW, machine: same as H-219A	Same as H-219A		
H-220F		WASHER, lock: same as H-210B	Same as H-210B		
H-220G		SCREW, machine: same as H-219A	Same as H-219A		
H-220H		WASHER, lock: same as H-210B	Same as H-210B		
H-220I		SCREW, machine: same as H-219A	Same as H-219A		
H-220J		WASHER, lock: same as H-210B	Same as H-210B		
H-220K		SCREW, machine: same as H-219A	Same as H-219A		
H-220L		WASHER, lock: same as H-210B	Same as H-210B		
H-220M		SCREW, machine: same as H-219A	Same as H-219A		
H-220N		WASHER, lock: same as H-210B	Same as H-210B		
H-221A		SCREW, machine: same as H-219A	Same as H-219A		
H-221B		WASHER, lock: same as H-210B	Same as H-210B		
H-222A		SCREW, machine: same as H-219A	Same as H-219A		
H-222B		WASHER, lock: same as H-210B	Same as H-210B		
H-223A		SCREW, machine: slot drive; RH; brass rhodium pl; #6-32; 3/16" lg; 3/16" lg thd; p/o Signal Generator TS-418/U	Cavity hardware	Transitron A-0109-00538-2	Transitron A-0109-00538-2
H-223B		WASHER, lock: same as H-210B	Same as H-210B		
H-224A		SCREW, machine: same as H-223A	Same as H-223A		
H-224B		WASHER, lock: same as H-210B	Same as H-210B		
H-225A		SCREW, machine: slot drive; RH; brass rhodium pl; #2-56; 1/8" lg; 1/8" lg thd; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Transitron A-0109-00540-2	Transitron A-0109-00540-2
H-225B		SCREW, machine: same as H-225A	Same as H-225A		
H-225C		SCREW, machine: same as H-225A	Same as H-225A		
H-225D		SCREW, machine: same as H-225A	Same as H-225A		
H-226		GROMMET: phenolic; fits .1875" diam hole; .0935" diam hole, .055" groove wd, .125" wd x .250" diam o/a; p/o Army-Navy Signal Generator TS-418/U	Provides mtg for R-203	Transitron A-0109-00328	Transitron A-0109-00328
H-227A		SCREW, machine: slot drive; bind H; brass rhodium pl; #2-56; 3/16" lg; 3/16" lg thd; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Transitron A-0109-00540-3	Transitron A-0109-00540-3
H-227B		WASHER, lock: same as H-215B	Same as H-215B		
H-227C		SCREW, machine: same as H-227A	Same as H-227A		
H-227D		WASHER, lock: same as H-215B	Same as H-215B		
H-227E		SCREW, machine: same as H-227A	Same as H-227A		
H-227F		WASHER, lock: same as H-215B	Same as H-215B		

TABLE 6-1—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
H-228		WASHER, flat: brass, rhodium pl; round .265" ID, ½" OD x .018" thk; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Transitron A-0109-00210	Transitron A-0109-00210
H-229		SCREW, machine: slot drive; RH; brass, rhodium pl; #6-32; ½" lg; ½" lg thd; p/o Army-Navy Signal Generator TS-418/U	Cavity hardware	Transitron A-0109-00538-3	Transitron A-0109-00538-3
H-230		SCREW, machine: same as H-229	Same as H-229		
H-231		SCREW, machine: same as H-229	Same as H-229		
H-232		SCREW, machine: slot drive; fil hd; brass; rhodium pl; #10-32; 1⅛" lg; 1⅛" lg thd; p/o Army-Navy Signal Generator TS-418A/U	Frequency control screw	Transitron A-0109-00335-2	Transitron A-0109-00335-2
I-201		DIAL: vernier; p/o Army-Navy Signal Generator TS-418/U; dial, aluminum, black enamel clear lacquer finish, hub cad pl iridited; 100 calibration lines equally spaced through 360 deg; 2¾" diam x ⅜" thk o/a; mts to .250" diam shaft w/two #6-22 set screws	Vernier	Transitron A-0109-00257	Transitron A-0109-00257
I-202		DIAL: attenuator indicating dial; p/o Army-Navy Signal Generator TS-418/U; dial aluminum black enamel clear lacquer finish hub cad pl iridited; outer scale 0 to 120 clockwise on 325 deg arc, inner scale .2 to 200K counter-clockwise on 324.9 deg arc; 4" diam x ⅜" thk o/a; mts to .250" diam shaft w/two #6-32 set screws	Attenuator indicating dial	Transitron B-0109-00261	Transitron B-0109-00261
I-203		DIAL: frequency indicating dial; c/o dial Transitron C-0109-00232, shaft Transitron A-0109-00239; hub; Transitron A-0109-00238; outer scale calibrated 400 to 1000 on 325 deg arc, inner scale calibrated 0 to 23 on 345 deg arc; 4" diam x 1 3/16" lg	Frequency indicating dial	Transitron B-0109-00231	Transitron B-0109-00231
J-201	8850-654440 R16-R-2435-1 2Z3062-167	CONNECTOR, receptacle: Army-Navy UG-291/U; single round female cont; straight type; 1⅛" lg x ⅜" diam; cylindrical brass body, silver pl; polystyrene insert; 3/16" diam cable opening; 11/16" x 11/16" mtg base; four .356 tapped mtg holes on ½" mtg centers	RF output jack	JAN UG-291/U	Navy Dwg RE49F246D
L-212		SUPPRESSOR, parasitic: resistor and coil; 3⅜" lg x 3/16" diam; inductance .23 uh; 12 turns #30 wire, 470K ohms ½ W resistor; two axial wire leads; p/o Army-Navy Signal Generator TS-418/U	Prevents entrance of RF signal to DC source for oscillator grid	Transitron A-0109-00333	Transitron A-0109-00333
O-201		CAP: Cavity end cap; p/o Army-Navy Signal Generator TS-418/U; brass, rhodium pl; 2.250" diam x .500" thk; mts to cavity by 2⅛"-32 thd; OD of cap knurled	Cavity end cap	Transitron A-0109-00254	Transitron A-0109-00254
O-202		GASKET: Cavity cap gasket; compressed monel metal; one hole; 2.078" diam x ⅛" thk; p/o Army-Navy Signal Generator TS-418/U	Cavity cap gasket	Transitron A-0109-00297	Transitron A-0109-00297

O-204A		BUSHING: ins thermistor from mtg screws; phenolic; male; .105" lg, .185" OD, .116" ID, shoulder ¼" diam; p/o Army-Navy Signal Generator TS-418/U	Insulates thermistor from mtg screw	Transitron A-0109-00310	Transitron A-0109-00310
O-204B		BUSHING: same as O-204A			
O-204C		BUSHING: same as O-204A			
O-204D		BUSHING: same as O-204A			
O-205		GUIDE, shaft: guides attenuator into cavity; p/o Army-Navy Signal Generator TS-418A/U; c/o mtg plate Transitron A-0109-00270, insert Transitron A-0109-00273 and adjusting screw Transitron A-0109-00274; 1 19/32" lg x 1" wd x 19/32" thk o/a; mts by two 6/32" diam holes on .688" mtg ctr	Attenuator guide	Transitron A-0109-00269	Transitron A-0109-00269
O-206		RETAINER, tube: provides mtg for JAN-2C36 and forms plate cont; p/o Army-Navy Signal Generator TS-418/U; brass, rhodium pl; 1.875" diam x .250" thk; four .156" diam mtg holes 90 deg apart	Provides mtg for V-201 and forms plate contact	Transitron A-0109-00344	Transitron A-0109-00344
O-207		SPRING: flat type; dial stop spring; beryllium copper, rhodium pl; 2.031" lg x .250" wd x .018" thk; five mtg holes, two .157" diam, two .098" diam, one .052" diam irregularly spaced; p/o Army-Navy Signal Generator TS-418/U	Spring for O-208	Transitron A-0109-00303	Transitron A-0109-00303
O-208		ARM: dial stop arm follower; p/o Army-Navy Signal Generator TS-418/U; brass, rhodium pl; 1.188" lg x .250" wd x .297" thk; two #2-56 tapped mtg holes on .750" mtg ctr	Cam follower for dial stop	Transitron A-0109-00309	Transitron A-0109-00309
O-209		GEAR: rack gear; brass, rhodium pl; cavity drive rack; straight teeth; 56 teeth; 48 pitch; 5 9/32" lg x 7/16" wd x ⅛" thk o/a; str face; one 6/32" diam mtg hole one end; p/o Army-Navy Signal Generator TS-418/U	Cavity drive rack	Transitron B-0109-00187	Transitron B-0109-00187
O-210		BLOCK, guide: carriage drive guide; p/o Army-Navy Signal Generator TS-418A/U; c/o carriage drive block Transitron A-0109-00130, bushing Transitron A-0109-00128, insert Transitron A-0109-00129 brass; 1 1/16" lg x 1⅛" wd x 1 3/16" h; 5 irregularly spaced mtg holes, ctr hole #6-32 tap, other holes #4-40 tap	Carriage drive guide block	Transitron A-0109-00127	Transitron A-0109-00127
O-211		SHAFT: cavity carriage drive shaft; p/o Army-Navy Signal Generator TS-418/U; ss; 5.53125" lg x .249" diam; mts w/10-32 thd .125" lg at end	Cavity carriage drive shaft	Transitron A-0109-00330	Transitron A-0109-00330
O-212		GUIDE, support: guides and supports cavity carriage p/o Army-Navy Signal Generator TS-418/U; brass rhodium pl; 7 13/16" lg x 1⅞" diam; eleven holes irregularly spaced on plate	Guides and supports cavity carriage	Transitron A-0109-00148	Transitron A-0109-00148
O-213		BRUSH, electrical contact: cavity grid cont; brass, rhodium pl; cylindrical shape w/two guide rods on one end, 6¼" lg x 1" diam o/a; mts by one slot in end of each rod, slot 9/32" lg x ⅛" wd; concave cont; p/o Army-Navy Signal Generator TS-418/U	Cavity grid contact fingers	Transitron B-0109-00134	Transitron B-0109-00134

TABLE 6-1—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
O-214		BRUSH, electrical contact: cavity plate cont; brass, rhodium pl; cylindrical shape w/two guide rods on one end, 8 7/16" lg x 2" diam o/a; mts by one slot in end of each rod, slot 9/32 lg x 1/8" wd; concave cont; p/o Army-Navy Signal Generator TS-418/U	Cavity plate contact	Transitron B-0109-00150	Transitron B-0109-00150
O-215		CAM: dial stop; p/o Army-Navy Signal Generator TS-418/U; brass, rhodium pl; 1.313" lg x .438" wd x .250" thk; mtg to dial shaft w/6-32 RH screw	Dial stop	Transitron A-0109-00150	Transitron A-0109-00150
O-216		CAM: same as O-215	Same as O-215		
O-217		SHAFT: vernier dial drive gear and shaft; p/o Army-Navy Signal Generator TS-418A/U; c/o gear Transitron A-0109-00242, shaft Transitron A-0109-00243 brass gear shaft, ss; 2 13/32" lg x 35/64" diam o/a	Vernier dial drive	Transitron A-0109-00240	Transitron A-0109-00240
O-218		GEAR: spur type; brass, cad pl and iridite; dial drive straight teeth; 36 teeth; 48 pitch, .750" pitch diam; OD .7916", ID .187", 1/8" thk; straight face; p/o Army-Navy Signal Generator TS-418/U	Dial drive gear	Transitron A-0109-00316	Transitron A-0109-00316
O-219		GEAR: spur type; cadmium pl brass iridite; dial drive gear, straight teeth; 144 teeth; 48 pitch, 3.000" pitch diam, 3 1/16" OD, .250" hole diam, gear .093" thk; hub extends .424" from one face; straight face; hub 1" diam mts to 1/8" shaft, locked by two #6-32 set screws 90 deg apart; p/o Army-Navy Signal Generator TS-418/U	Dial drive gear	Transitron B-0109-00229	Transitron B-0109-00229
O-220		SHAFT: cavity drive pinion gear and shaft; p/o Army-Navy Signal Generator TS-418/U; c/o gear Lavoie Lab part/dwg #A-1367283, shaft Lavoie Lab part/dwg #A-1367271; brass gear cad pl, ss, shaft; 2 15/32" lg x 27/64" diam o/a	Cavity drive pinion gear	Transitron A-0109-00205	Transitron A-0109-00205
O-221		SPRING: guide; flat type; carriage drive guide; beryllium copper rhodium pl; .796" lg x .500" wd x .015" thk; three .094" diam mtg holes two on one end on .313" mtg c, one on ctr line; p/o Army-Navy Signal Generator TS-418/U	Carriage drive guide	Transitron A-0109-00213	Transitron A-0109-00213
O-222		PLATE, spacer: spacer in carriage drive; p/o Army-Navy Signal Generator TS-418/U; brass rhodium pl; .500" lg x .188" wd x .031" thk; two .094" mtg holes on .313" mtg ctr	Spacer in carriage drive	Transitron A-0109-00214	Transitron A-0109-00214
O-223		BEARING, sleeve: bearing for dial drive shaft, brass rhodium pl; female bushing; 1.482" lg x .437" diam w/.500" sq end, .417" diam x .188" lg undercut; p/o Army-Navy Signal Generator TS-418/U	Bearing for dial drive shaft	Transitron A-0109-00211	Transitron A-0109-00211
O-224		ARM: attenuator stop arm; p/o Army-Navy Signal Generator TS-418/U; hard drawn brass rhodium pl; no diam of this item is greater than one inch	Attenuator stop arm	Transitron A-0109-00322	Transitron A-0109-00322

O-225		SHAFT: attenuator drive gear; p/o Arm-Navy Signal Generator TS-418A/U; c/o gear Transitron A-0109-00245 and sleeve bearing Transitron A-0109-00248; $3\frac{21}{32}$" lg x $2\frac{3}{32}$" diam; mts by $\frac{3}{8}$-32" bushing	Attenuator drive gear	Transitron A-0109-00245	Transitron A-0109-00245
O-226		SHIELD, end: p/o RF Oscillator shield which has contacts to prevent leakage around attenuator; p/o Army-Navy Signal Generator TS-418A/U; c/o plate Transitron A-0109-00203 and contact Transitron B-0109-00174-1; $2\frac{19}{32}$" lg x $2\frac{15}{32}$" wd x $\frac{35}{64}$" h o/a; mts by eight .120" diam mtg holes irregularly spaced	Prevents RF leakage around attenuator	Transitron B-0109-00198	Transitron B0109-00198
O-227		CAP: p/o Army-Navy Signal Generator TS-418A/U; cad pl brass, gray enamel; 2.865" diam x 0.250" thk; four 0.093" diam mtg holes located 90° apart on circum	End cover for cavity shield	Transitron B-0109-00196	Transitron B-0109-00196
O-228		CAP: p/o Army-Navy Signal Generator TS-418A/U; cad pl brass, gray enamel; 2.865" diam x 0.250" thk; three 0.120" diam mtg holes located 120° apart on rad	End cover for cavity shield	Transitron B-0109-00195	Transitron B-0109-00195
R-201	3300-381219680 -R16-R-17263-59-3 3RC21BF471K	RESISTOR, fixed: comp; 470 ohms ±10%; ½ w; "F" characteristic; .655" lg x .249" diam; two axial wire leads	Element of filter for RF oscillator plate lead	JAN RC21BF471K	JAN-R-11
R-202		RESISTOR, fixed: comp; 56 ohms ±3%; 0.5 w; "F" characteristic; .140" diam x .375" lg; two axial wire leads	Terminates generator end of RF transmission line — p/o RF Probe E-203A	JAN RC20BF560J	JAN-R-11
R-203	3300-381168880 R16-R-17279-0-915 3RC20BF332J	RESISTOR, fixed: comp; 3300 ohms ±5%; ½ w; "F" characteristic; .468" lg x .249" diam; two axial wire leads	Part of grid leak for V-201 Couples RF oscillator grid to plate of V-306	JAN RC20BF332J	JAN-R-11
R-204		RESISTOR, thermal: bead thermistor glass envelope, 33-47 ohms w/25 ma; $1\frac{2}{32}$" lg x $\frac{1}{8}$" diam; glass ins; axial wire leads 1¾" lg	Provides change in bridge balance	VECO 32A3	
R-205	R16-R-17258-21-400	RESISTOR, fixed: comp; 68 ohms ±10%; ½ w; "F" characteristic; .468" lg x .249" diam; two axial wire leads	Matching resistor of monitor pick-up loop	JAN RC20BF680K	JAN-R-11
V-201	3300-234190062 16-T-52336 2J2C36	TUBE, electron: Sylvania Prod 2C36; high freq triode	Functions as UHF oscillator	Sylvania Prod 2C36	
	R17-W-3208	WIRE, electrical: #38 AWG nichrome wire, single layer; glass braid ins, silicone impre, resistance 42.19 ohms/ft at 68° F; wire w/ins not to be greater than .0085"	Bulk quantity to fabricate W-202		
W-203		LEAD, electrical: JAN type SRIR 1 (7) 20-C-1; 8" lg; term Lavoie Lab Part/dwg #A-1367242; one end, other end tinned; Lavoie Lab Part/dwg #A-1367428; p/o Army-Navy Signal Generator TS-418/U	Filament lead from V-201	Transitron A-0109-00145	Transitron A-0109-00145
Z-201		FILTER, low pass: rejects all freq above 5 mc; $4\frac{11}{16}$" lg x ½" diam; cylindrical brass, rhodium pl case; mtgs by single #10-32 thd stud at one end and wire lead at other end; p/o Signal Generator TS-418/U	Prevents RF power from reaching plate supply	Transitron B-0109-00124	Transitron B-0109-00124

TABLE 6-1—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
Z-202		FILTER, low pass: rejects all freq above 5 mc; 3 1/16" x 1 1/8" diam; cylindrical, rhodium pl case; mts by single 3/8"-32 thd stud at one end; two wire leads at mtg end, two solder lug term at other end; p/o Signal Generator TS-418/U	Prevents RF power from reaching filament and grid supplies	Transitron B-0109-00106	Transitron B-0109-00106
††Z-203		FILTER, low pass: rejects all freq above 5 mc; 2 1/2" lg x 1/2" diam; cylindrical brass, rhodium plated case; mts by single #10-32 thd stud at one end; single wire lead at mtg end; p/o Army-Navy Signal Generator TS-418A/U	Prevents RF leakage from cavity	Transitron C-0109-00102	Transitron C-0109-00102
††Z-204		FILTER, low pass: same as Z-203	Same as Z-203		
Z-205		FILTER, low pass: rejects all freq above 5 mc; 5 1/2" lg x 1/2" diam; cylindrical brass, rhodium plated case; mts by single #10-32 thd stud at one end; single wire lead at ea end and solder lug term at other end; p/o Army-Navy Signal Generator TS-418A/U	Prevents RF leakage from cavity	Transitron B-0109-00116	Transitron B-0109-00116
††Z-206		FILTER, low pass: same as Z-203	Same as Z-203		
		PULSE GENERATING AND MODULATING CIRCUIT			
C-301		CAPACITOR, fixed: same as C-108	Couples external sync jack to sync selector switch		
C-302	3300-317760138 R16-C-11252-600 3DA100-913	CAPACITOR, fixed: paper; .1 mf ±10%; 600 vdcw; Hs metal case; 1 5/16 lg x 49/64" wd x 1 3/8" h; two solder lug term on bottom; two .156" mtg slots	Couples output of V-301A to sync selector switch	JAN CP65B1DF104K	JAN-C-25
C-303	3300-376037780 R16-C-10026-10-30 3K2051142	CAPACITOR, fixed: mica; 510 mmf ±5%; 500 vdcw; molded low loss bakelite case; 51/64" lg x 15/32" wd x 7/32" thk; two #20 axial wire leads	Couples positive sync T-301	JAN CM20D511J	JAN-C-5
C-304		CAPACITOR, fixed: same as C-302	Couples output plate of V301B to grid of V-302A		
C-305		CAPACITOR, fixed: same as C-303	Couples output of V-301B to T-301		
C-306A C-306B	3300-317760140 R16-C-11333-100-25 3DA100-915	CAPACITOR, dual: paper; each secti .1 mf ±15%; 600 vdcw; oil filled and impr; 1 5/16" lg x 49/64" wd x 1 3/8" h; two solder lug term on bottom; two .156" mtg slots	Determines pulse freq on X1 range	JAN CP65B6DF104L	JAN-C-25
C-307	3300-376182460 R16-C-10465-56 3K4068252	CAPACITOR, fixed: mica; 6800 mmf ±5%; 500 vdcw; molded low loss bakelite case; 1 1/32" lg x 41/64" wd x 11/32" thk; two #18 axial wire leads	Determines pulse freq on X10 range	JAN CM40E682J	JAN-C-5
C-308	3300-313889986 R16-C-8345-1-100 3D9100-259	CAPACITOR, fixed: ceramic; 100 mmf ±10%; 500 vdcw; 1.328" lg x .340" diam; neg temp coef —150 (tol ±25) mmf/mf/°C; two axial wire leads	Couples output of V-302A to cathode V-302B	JAN CC36PK101K	JAN-C-20-A

C-309	3300-316958883 R16-C-11419-2-100 3DB1-261	CAPACITOR, fixed: paper; 1 mf ±10%; 600 vdcw; oil filled and impr 1 5/16" lg x 49/64" wd x 2 1/2" h; two solder lug term on bottom; two .156" mtg slots	Filter element for —105V supply	JAN CP65B1DF105K	JAN-C-25
C-310	3300-376143250 R16-C-10077-2 3K3091143	CAPACITOR, fixed: mica; 910 mmf ±2%; 500 vdcw; molded low loss bakelite case; 53/64" lg x 53/64" x 3/32" thk; two #18 axial wire leads	Determines duration of Pulse delay	JAN CM30D911G	JAN-C-5
C-311	3300-313184085 R16-C-7867-34-60 3D9024-10	CAPACITOR, fixed: ceramic; 24 mmf ±5%; 500 vdcw; neg temp coef zero (tol +60) mmf/mf/°C; .812" lg x .250" diam; two axial wire leads	Differentiates and couples output plate of V-303B to grid V-306	JAN CC26CH240J	JAN-C-20A
C-312	3300-376036600 R16-C-9872-37 3K2051032	CAPACITOR, fixed: mica; JAN type CM20C510J; 51 mmf ±5%; 500 vdcw; molded low loss bakelite case; 51/64" lg x 15/32" wd x 7/32" thk; two #20 axial wire leads	Couples trigger to sync out circuit	JAN CM20C510J	JAN-C 25
C-313	3300-376002000 R16-C-9924-61 3K2010121	CAPACITOR, fixed: mica; JAN type #CM20B101K; 100 mmf ±10%; 500 vdcw; molded low loss bakelite case; 51/64" lg x 15/32" wd x 7/32" thk; two axial wire leads	Determines natural freq of blocking oscillator	JAN CM20B101K	JAN-C 25
C-314		CAPACITOR, fixed: same as C-108	Blocking capacitor		
C-315	3300-313889985 R16-C-8335-400 3D9100-258	CAPACITOR, fixed: ceramic; 100 mmf ±2%; 500 vdcw; neg temp coef zero (tol +60) mmf/mf/°C; .328" lg x .340" diam; two axial wire leads	Couples plate of V-305A to grid of V-306; determines pulse duration	JAN CC36CH101G	JAN-C-20A
C-316	3300-313584160 R16-C-8276-238 3D9051-11	CAPACITOR, fixed: ceramic; JAN CC36CH510G; 51 mmf ±2%; 500 vdcw; neg temp coef zero (tol +60) mmf/mf/°C; .328" lg x .340" diam; two axial wire leads	Couples grid of V-306 to grid of V-305A; determines pulse duration	JAN CC36CH510G	JAN-C-20A
C-317	3300-317680796 R16-C-11255-23-50 3DA10-367	CAPACITOR, fixed: paper; molded JAN CN35A103M; 10,000 mmf ±20%; 600 vdcw; oil filled and impr; black molded bakelite; 53/64" lg x 53/64" wd x 11/32" thk; two axial wire leads	Couples output plate V-305B to grid of V-306	JAN CN35A103M	JAN-C-91
C-318	3300-376018000 R16-C-9814-96 3K2024032	CAPACITOR, fixed: mica; JAN type #CM20C240J; 24 mmf ±5%; 500 vdcw; molded low loss bakelite case; 51/64" lg x 15/32" wd x 7/32" thk; two #20 axial wire leads	Couples trigger from modulator tube to inverter for delayed sync circuit	JAN CM20C240J	JAN-C-25
C-319		CAPACITOR, fixed: same as C-313	Same as C-313		
C-320	3300-312860530 R16-C-7855-250 3D9005-70	CAPACITOR, fixed: ceramic dielectric; JAN type #CC21CK050C; 5 mmf ±0.25 mmf; 500 vdcw; neg temp coef zero (tol +250) mmf/mf/0°C; .562" lg x .250" diam; two axial wire leads	Suppresses spurious oscillation	JAN CC21CK050C	JAN-C-20A
C-321		CAPACITOR, fixed: same as C-318	Couples output of pulse rate blocking oscillator to inverter tube V-304A		
C-322		CAPACITOR, fixed: same as C-318	Widens sync out pulse		
C-323		CAPACITOR, fixed: same as C-318	Widens delayed sync out pulse		
C-324A C-324B		CAPACITOR, dual: same as C-306A & B	Part of RC filter		
C-341		CAPACITOR, fixed: same as C-312	Couples inverter tube output to delayed sync circuit		

TABLE 6-1—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
E-302	Not used				
E-303		BOARD #1, terminal: resistor binding post strip; 42 solder lug term; brass, silver pl; eight pr at 1⅞" centers, thirteen pr at 1⅜" centers; molded phenolic xxx bakelite; 8⅞" lg x 2½" wd x ⅛" thk; five #31 (.120) drill mtg holes; four 8½" x 1½" mtg centers, one on centerline; 1/32" thk bakelite plate mtd on back	To support circuit components R-303, R-304, R-305, R-307, R-308, R-310, R-318, R-319, R-327, R-328, R-329, R-330, R-344, R-345, C-305, C-313, C-315, C-316, C-317	Transitron B-0109-00426	Transitron B-0109-00426
E-304		BOARD #2, terminal: resistor binding post strip; 40 solder lug term, brass, silver pl, irregularly spaced; 8⅞" lg x 2½" wd x ⅛" thk; molded phenolic xxx bakelite; 5 #31 (.120) drill mtg holes, 4 on 8½" x 1½" mtg centers 1 on centerline	To support circuit components R-309, R-310, R-311, R-312, R-314, R-315, R-321, R-323, R-324, R-337, R-338, R-341, R-342, R-343, C-303, C-307, C-308, C-312, C-318	Transitron B-0109-00430	Transitron B-0109-00430
E-305		BOARD #3, terminal: resistor binding post strip; 4 solder lug term; brass, silver pl; each pair on 1⅞" centers; 2½" lg x 1½" wd x ⅛" thk; molded phenolic xxx bakelite; two #31 (.120) drill mtg holes on 1" centers	To support circuit components R-332, R-333	Transitron A-0109-00436	Transitron A-0109-00436
E-306		BOARD #4, terminal: resistor binding post strip; 20 solder lug term; brass silver pl; 10 pr on 1⅜" centers; 5⅛" lg x 2" wd x ⅛" thk; molded phenolic xxx bakelite; two #26 (.147) drill mtg holes on 3⅛" centers	To support circuit components R-346, R-347, R-348, R-350, R-351, R-353, R-356, R-357, R-359, R-361	Transitron B-0109-00440	Transitron B-0109-00440
E-307	Not used				
E-308		BOARD #9, terminal: resistor binding post strip; two solder lug term; brass, silver pl; 1⅜" apart; 2¼" lg x 1½" wd x ⅛" thk; molded phenolic xxx bakelite; two #31 (.120) drill mtg holes 1⅛" x 1⅜" apart; bakelite plate 1/32" thk mtd on back; metal clamp for holding resistors, mts on two #31 (.120) drill holes 1⅛" apart on centerline	To mount resistor R-354	Transitron B-0109-00466	Transitron B-0109-00466
E-309		KNOB, black molded: 1⅛" diam x ⅝" h; shaft hole ¼" diam x½" lg; two Allen head, flat point set screws	For adjusting R-358	Kurz-Kasch S-308-64BBB	
E-310		KNOB: same as E-309	For adjusting R-360		
E-311		KNOB: black molded, 1⅛" diam x ⅝" h; shaft hole ¼" diam x ½" lg; two Allen head, flat point set screws; #135 brass insert pointer staked on	For adjusting S-302	Kurz-Kasch S-308-64-BB-40269	

E-312		KNOB: same as E-311	For adjusting S-303		
E-313		SHIELD, tube: same as E-106	Tube shield for V-308		
E-314		SHIELD tube: durable steel; cylindrical; $1\frac{15}{16}$" lg; complete with tube securing spring; "J" slot	Shield for tube V-301	Elco 148	
E-315		SHIELD, tube: same as E-314	Shield for V-302		
E-316		SHIELD, tube: same as E-104	Tube shield for V-303		
E-317		SHIELD, tube: same as E-104	Tube shield for V-304		
E-318		SHIELD, tube: same as E-104	Tube shield for V-305		
E-319		SHIELD, tube: same as E-104	Tube shield for V-307		
E-320		BOARD #10, terminal: 3 silver pl brass solder lug term; term irregularly located; phenolic; $1\frac{3}{8}$" lg x $\frac{3}{4}$" wd x $\frac{1}{2}$" h; two 0.147" diam mtg holes 1" c to c; moisture-fungus proofed; p/o Army-Navy Signal Generator TS-418A/U	Provides terminals for filter leads	Transitron A-0109-00467	Transitron A-0109-00467
I-301		DIAL: pulse delay indicating dial; p/o Army-Navy Signal Generator TS-418/U; aluminum disc staked on phenolic knob; $2\frac{1}{4}$" diam x .063" thk disc on knob $1\frac{1}{8}$" diam x $\frac{5}{8}$" thk; mts to .250" diam shaft by two #8-32 set screws; marked 3-300 microseconds on circum	Indicated delay of RF pulse output signal	Transitron A-0109-00414	Transitron A-0109-00414
I-302		DIAL: pulse width indicating; p/o Army-Navy Signal Generator; aluminum disc staked to phenolic knob; $2\frac{1}{4}$" diam x .063" thk, W/Knob $1\frac{1}{8}$" diam x $\frac{5}{8}$" thk; mts to .250" diam shaft by two #8-32 set screws 90 deg apart; one scale 0-10 u sec counterclockwise on circum	Indicated width of RF pulse output signal	Transitron A-0109-00409	Transitron A-0109-00409
I-303		DIAL: pulse rate indicating; p/o Army-Navy Signal Generator TS-418/U; aluminum disc staked on phenolic knob; $2\frac{1}{4}$" diam x .063" thk disc on knob $1\frac{1}{8}$" diam x $\frac{5}{8}$" thk; mts to .250" diam shaft by two #8-32 set screws; marked 40—400 cyc; counterclockwise	Indicates repetition rate of RF pulse output signal	Transitron A-0109-00412	Transitron A-0109-00412
J-302		CONNECTOR, female contact: single round female cont; straight type; $3\frac{1}{4}$" lg x $\frac{3}{4}$" o/a; cylindrical brass body, silver pl; polystyrene insert; $\frac{11}{16}$" x $\frac{11}{16}$" mtg base, four mtg holes tapped for #4-40 screws; includes RF filter, $2\frac{3}{4}$" lg x $\frac{1}{2}$" diam o/a, brass, silver pl; mts to connector base with $\frac{3}{4}$" square flange, 4 mtg holes tapped for 3-56 screws	SYNC IN jack	Transitron B-0109-00419	Transitron B-0109-00419
J-303		CONNECTOR: same as J-302	SYNC OUT jack		
J-304		CONNECTOR: same as J-302	EXT MOD jack		
J-305		CONNECTOR: same as J-302	DELAYED SYNC OUT jack		

TABLE 6-1—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
L-301		Not used			
M-301		METER, audio level: —6 to +3 db; round metal, flush mtg HS case; 1.433" lg x 2.695" diam; 2% accuracy D'Arsonval movement; calibrated for non-magnetic panel; 13 scale divisions; black numerals, white background; self contained; three 4-40 x 3/8" round head mts s screws; 120° apart on rad; two solder lug term; Marion Elec Instr Model HS2 w/spc/scale	Monitors RF Output	Transitron B-0109-00416	Transitron B-0109-00416
O-301	3300-298303130 R16-AN-CW-123/U 2Z3350-123	CAP: Army-Navy Cap CW-123/U, cover for UG-290/U connector; brass silver pl; no dimension larger than 1"; held to front of set by chain 2½" lg, eyelet each end	Cover for Jack J-302	CW-123/U	Navy Dwg RE49F331
O-302		CAP: same as O-301	Cover for Jack J-303		
O-303		CAP: same as O-301	Cover for Jack J-304		
O-304		CAP: same as O-301	Cover for Jack J-305		
O-305		RETAINER, tube: same as O-101	Lock for V-306		
R-303	3300-381366220 R16-R17347-15-100 3RC31BF104K	RESISTOR, fixed: comp; 100,000 ohms ±10%; 1 w; 1.28" lg x .310" diam; two axial wire leads	Plate load resistor for V-301A	JAN RC313BF104K	JAN-R-11
R-304		RESISTOR, fixed: same as R-108	Grid resistor for V-301A		
R-305	3300-381217080 R16-R-17268-25-500 3RC21BF152K	RESISTOR, fixed: comp; 1500 ohms ±10%; ½ w; .655" lg x .249" diam; two axial wire leads	Provides grid cathode bias for V-301A	JAN RC21BF152K	JAN-R-11
R-306	3300-381216160 R16-R-17310-1-500 3RC21BF103K	RESISTOR, fixed: comp; 10,000 ohms ±10%; ½ w; .655" lg x .249" diam; two axial wire leads	Provides discharge path for C-301	JAN RC21BF103K	JAN-R-11
R-307	3300-381219800 R16-R-17331-75-500 3RC21BF473K	RESISTOR, fixed: comp; 47,000 ohms ±10%; ½ w; .655" lg x .249" diam; two axial wire leads	Provides grid cathode bias for V-301B	JAN RC21BF473K	JAN-R-11
R-308		RESISTOR, fixed: comp; 33,000 ohms ±10%; 2 w; 1.78" lg x .405" diam; two axial wire leads	Plate load resistor for V-301B	JAN RC42BF333K	JAN-R-11
R-309	3300-381369860 R16-R-17354-14-224 3RC31BF474K	RESISTOR, fixed: comp; 470,000 ohms ±10%; 1 w; 1.28" lg x .310" diam; two axial wire leads	P/O grid resistance for V-302A	JAN RC31BF474K	JAN-R-11
R-310		RESISTOR, fixed: same as R-108	P/O grid resistance for V-302A		
R-311	3300-381216280 R16-R-17375-5 3RC21BF105K	RESISTOR, fixed: comp; 1 meg ±10%; ½ w; .655" lg x .249" diam; two axial wire leads	P/O grid resistance for V-302A	JAN RC21BF105K	JAN-R-11

R-312	3300-381167120 R16-R-17310-59-100 3RC20BF153J	RESISTOR, fixed: comp; 15,000 ohms ±5%; ½ w; .468" lg x .249" diam; two axial wire leads	Determines high freq end on X1 and X10 ranges	JAN RC20BF153J	JAN-R-11
R-313		RESISTOR, variable: 200,000 ohms ±10%; 2 w; 500 V max; 1 1/16" diam x 9/16" lg; shaft .250" diam x 7/8" lg; lin taper; three term	Provides variation of pulse freq	AB J44515	
R-314		RESISTOR, fixed: same as R-306	Provides positive bias for V-302B		
R-315	3300-381216220 R16-R-17345-5 3RC21BF104K	RESISTOR, fixed: comp; 100,000 ohms ±10%; ½ w; .655" lg x .249" diam; two axial wire leads	Plate load for V-302A	JAN RC21BF104K	JAN-R-11
R-316	3300-380057040 R16-P-6893-100 3RA5704	RESISTOR, variable: wire wound; 1000 ohms ±10%; 4 w; no switch; normal torque; slotted shaft ½" lg; lin taper; 1.47" lg x 1.78" diam	Plate load for V-302A on X10	JAN RA30A1SA102AK	JAN-R-19
R-317		RESISTOR, variable: same as R-316	Plate load for V-302A on X1		
R-318	3300-381218960 R16-R-17327-3 3RC21BF333K	RESISTOR, fixed: comp; 33,000 ohms ±10%; ½ w; .655" lg x .248" diam; two axial wire leads	Plate load for V-303A	JAN RC21BF333K	JAN-R-11
R-319	3300-371217980 R16-R-17262-55-43 3RC21BF221J	RESISTOR, fixed: comp; JAN type #RC21BF221J; 220 ohms ±5%; ½ w; .655 lg x .249" diam; two axial wire leads	Determines minimum delay	JAN RC21BF221J	JAN-R-11
R-320		RESISTOR, variable: 250,000 ohms ±10%; 2 w; 500 V max; 1/16" diam x 9/16" lg; shaft 7/8" lg x .250" diam; lin taper; three term	Provides variation of pulse delay	AB J44516	
R-321	3300-381367080 R16-R-17268-30-100 3RC31BF152K	RESISTOR, fixed: comp; 1500 ohms ±10%; 1 w; 1.28" lg x .310" diam; two axial wire leads	Maintains grid voltage of V-303A	JAN RC31BF152K	JAN-R-11
R-322		RESISTOR, fixed: wire wound; 15,000 ohms ±5%; 30 w at 250°C max operating temp; 3" lg x 9/16" diam; IRC type B cement coating; two solder lug term	Plate load of V-302B	IRC 3" D	
R-323	3300-381217180 R16-R-17348-15-100 3RC21BF154J	RESISTOR, fixed: 150,000 ohms, ±5%; ½ w; .468" lg x .249" diam; two axial wire leads	Grid resistor for V-304B	JAN RC21BF154J	JAN-R-11
R-324		RESISTOR, fixed: same as R-311	Couples bias to V-304B		
R-325		RESISTOR, fixed: same as R-306	Provides discharge path for C-313		
R-326		RESISTOR, fifixed: same as R-201	Cathode resistor for sync out tube		
R-327	3300-381217260 R16-R-17383-100 3RC21BF155K	RESISTOR, fixed: comp; 1.5 meg ±10%; ½ w; .655" lg x .249" diam; two axial wire leads	Maintains grid at potential of R-344 and R-345	JAN RC21BF155K	JAN-R-11
R-328		RESISTOR, fixed: same as R-306	Plate load of V-305A		
R-329		RESISTOR, fixed: comp; 4700 ohms ±10%; 2 w; 1.78" lg x .405" diam; two axial wire leads	Plate load of V-305B	JAN RC42BF472K	JAN-R-11

CONTRACT N383s-83807

TABLE 6-1—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
R-330		RESISTOR, fixed: same as R-315	Maintains grid at potential of R-344 and R-345		
R-331	3300-385303220 R16-R-18687-85 3RW30322	RESISTOR, fixed: WW; 10,000 ohms ±5%; 9 w; 3" lg x 19/32" diam; ins, inductive; two tab term	Determines screen potential of V-306	JAN RW34C103	JAN-R-26
R-332	3300-385243180 R16-R-18654-105 3RW24318	RESISTOR, fixed: WW; 1000 ohms ±5%; 5 w; 2 5/16" lg x 5/8" diam; ins, inductive; two tab term	P/O coupling impedance between V-306 and V-201	JAN RW50J102	JAN-R-26
R-333		RESISTOR, fixed: same as R-332	Same as R-332		
R-334		RESISTOR, variable: 50,000 ohms ±10%; 2 w; 9/16" lg x 1 1/16" diam; shaft 7/8" lg x .250" diam; JAN-C taper; three term	Provides variation of pulse width	AB J44517	
R-335		RESISTOR, variable: 5000 ohms ±10%; 2 w; 1 3/16" lg x 1 1/16" diam; shaft 5/8" lg x .250" diam; lin taper; three term	Determines minimum end of pulse width range	AB J44518	
R-336		RESISTOR, fixed: same as R-311	Part of grid resistance for V-302A		
R-337		RESISTOR, fixed: same as R-323	Grid resistor for V-307		
R-338		RESISTOR, fixed: same as R-311	Couples bias to V-307		
R-339		RESISTOR, fixed: same as R-201	Cathode resistor for delayed sync out tube		
R-341		RESISTOR, fixed: comp; 3300 ohms ±5%; 2 w; 1.78" lg x .405" diam; two axial wire leads	P/O voltage divider which provides bias for V-302A	JAN RC42BF322	JAN-R-11
R-342		RESISTOR, fixed: same as R-341	Same as R-341		
R-343	3300-381170500 R16-R-17264-56-17 3RC20BF681J	RESISTOR, fixed: comp; 680 ohms ±5%; ½ w; .468" lg x .249" diam; two axial wire leads	Same as R-341	JAN RC20BF681J	JAN-R-11
R-344	3300-381219840 R16-R-17354-14-170 3RC21BF474J	RESISTOR, fixed: comp; 470,000 ohms ±5%; ½ w; .655" lg x .240" diam; two axial wire leads	P/O voltage divider which provides bias for V-305A and V-305B	JAN RC21BF474J	JAN-R-11
R-345	3300-381218160 R16-R-17352-1-14 3RC21BF224J	RESISTOR, fixed: comp; 220,000 ohms ±5%; ½ w; .655" lg x .249" diam; two axial wire leads	Same as R-344	JAN RC21BF224J	JAN-R-11
R-346	3300-390471085 R16-R-17262-55-107 3Z6024-15	RESISTOR, fixed: comp; 240 ohms ±2%; ½ w; temp coef of resistance will not exceed .0005 neg; 9/32" x 5/8"; special rubberized enamel ins	Arm of monitor bridge network	Concarbon X ½ 240 ohms ±2%	

R-347	3300-389816717 R16-R-17257-110 3Z6002B2-28	RESISTOR, fixed: comp; 22 ohms ±2%; ½ w; temp coef of resistance will not exceed .0005 neg; 9/32" x 5/8"; special rubberized enamel ins	Component of RF monitor temp compensating circuit	Concarbon X ½ 22 ohms ±2%	
R-348		RESISTOR, fixed: same as R-346	Same as R-347		
R-349		RESISTOR, thermal: disc thermistor; 803 ohms ±5% at 75° F; 1¼" lg x 7/8" wd x 5/16" thk; mts by four .187" diam mtg holes on 1.000" x .625" ctr; p/o Army-Navy Signal Generator TS-418/U, modified from VECO #28D1 by enlarging mtg holes	Component of RF monitor temperature compensating circuit	Transitron A-0109-00311	Transitron A-0109-00311
R-350		RESISTOR, fixed: same as R-346	Same as R-346		
R-351		RESISTOR, fixed: same as R-346	Same as R-346		
R-352		RESISTOR, fixed: same as R-311	Grid resistor for V-304A		
R-353	3300-389902690 R16-R-17258-53-8 3Z6003J9-1	RESISTOR, fixed: comp; 39 ohms ±2%; ½ w; 9/32" x 5/8"; temp coef will not exceed .0005" neg; special rubberized enamel ins	Same as R-347	Concarbon X ½ 39 ohms ±2%	
R-354		RESISTOR, fixed: same as R-118	Provides DC voltage for monitor bridge circuit		
R-355		RESISTOR, thermal: disc thermistor; 765 ohms at 75° F ±5%; rectangular metal plate 1¼" lg x 7/8" wd; 5/16" h; wire lead 4" lg	Same as R-349	VECO 27D1	
R-356	3300-390784282 R16-R-17263-58-50 3Z6047-28	RESISTOR, fixed: comp; 470 ohms ±2%; ½ w; 9/32" x 5/8"; temp coef will not exceed .0005" neg; special rubberized enamel ins	Same as R-347	Concarbon X ½ 470 ohms ±2%	
R-357	3300-389892088 R16-R-17258-52-36 3Z6003F6-11	RESISTOR, fixed: comp; 36 ohms ±2%; ½ w; 9/32" x 5/8"; temp coef of resistance will not exceed .0005" neg; special rubberized enamel ins	Same as R-347	Concarbon X ½ 36 ohms ±2%	
R-358	3300-380066180 R16-P-6905-420 3RA6618	RESISTOR, variable: 3500 ohms ±10%; 4 w; no switch; normal torque; 1.47" lg x 1.78" diam; ½" lg slotted shaft; lin taper; three solder lug term	ZERO SET control	JAN RA30A1RD-352K	JAN-R-19
R-359		RESISTOR, fixed: same as R-323	Determines low end of DC		
R-360		RESISTOR, variable: 250,000 ohms ±10%; 2 w; 2 9/16" lg x 1 1/16" diam; shaft 7/8" lg x .250" diam; lin taper; three term	Provides variation of cavity plate voltage	AB JLU5021	
R-361	3300-381216200 R16-R-17344-190-100 3RC21BF104J	RESISTOR, fixed: comp; 100,000 ohms ±5%; ½ w; .655" lg x .240" diam; two axial wire leads	Determines high voltage end of regulated DC output	JAN RC20BF104J	JAN-R-11
R-362		RESISTOR, fixed: comp; 22,000 ohms ±10%; 2 w; 1.78" lg x .405" diam; two axial wire leads	Plate load for V-304A	JAN RC42BF233K	JAN-R-11
R-363		RESISTOR, fixed: comp; 1000 ohms ±10%; 2 w; 1.78" lg x .405" diam; two axial wire leads	Part of RC Filter	JAN RC42BF102K	JAN-R-11

TABLE 6-1—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
R-364		RESISTOR, fixed: same as R-363	Part of RC Filter		
R-365		RESISTOR, fixed: same as R-203	Damping resistor for pulse rate blocking oscillator transformer		
R-366		RESISTOR, fixed: same as R-311	Grid resistor for inverter tube V-307B		
R-367		RESISTOR, fixed: same as R-362	Plate resistor for inverter tube V-307B		
S-302	3300-395499465 R17-S-25517-25 3Z9825-62.273	SWITCH, rotary: double pole 5 position; 3 sect; silver pl brass cont; phenolic body; 2⅞" lg x 1⅞" wd x 9/16 h; solder lug term; mts by ⅜" diam by ⅜-32" bushing	Selects the proper sync and/or modulation voltages	Oak Part No. 39300-DH3	Transitron C-0109-00418
S-303		SWITCH, rotary: same as S-302	Same as S-302		
S-304		SWITCH, toggle: SPST; black phenolic body; 1 9/32" lg x 9/16" h x 31/32" wd; two solder lug term; mts by ⅜" diam by ⅜-32" bushing	For application of DC plate voltage to RF Oscillator tube V-201	JAN ST12A	JAN-S-23
T-301		TRANSFORMER, pulse: blocking osc 40 to 4000 pps, 0.5 to 10 us; #1 wnd 90 ohm imped 5.08 ohm DC resistance, #2 wnd 95 ohm imped 3.65 ohm DC resistance; #1 wnd 93v 316 ma, #2 wnd 80v 25 ma; 2500 v ins; HS metal case; 2 1/32" lg o/a x 1 1/32" diam; vacuum impr w/ZOPHAR #1592 hard wax; 4 solder lug term on mtg end; two #4-40 tapped holes on ⅜" ctr on end	Blocking oscillator transformer	Transitron C-0109-00512	Transitron C-0109-00512 and JAN-T-27
T-302		TRANSFORMER, pulse: same as T-301	Sync out blocking oscillator transformer		
T-303		TRANSFORMER, pulse: same as T-301	Delayed sync out blocking oscillator transformer		
V-301	3300-234942400 16-T-58241-60 2J12AX7	TUBE, electron: miniature Hi-Mu twin triode; 9 pin	Prepares sync for pulse generator	JAN 12AX7	JAN-1-A
V-302	3300-234942000 16-T-58240-10 2J12AT7	TUBE, electron: twin triode, 9 pin	Internal pulse rate generator and diode clipper	JAN 12AT7	JAN-1-A
V-303		TUBE, electron: same as V-103	One shot delay multivibrator		
V-304		TUBE, electron: same as V-103	Sync out amplifier		
V-305		TUBE, electron: same as V-103	P/O width multivibrator and ext mod pulse inverter		

V-306		TUBE, electron: same as V-104	P/O width multivibrator and modulator tube		
V-307		TUBE, electron: same as V-103	Delayed sync out amplifier		
X-301		SOCKET, tube: 9 cont miniature; one piece saddle mtg; two 1/8" diam mtg holes on a 1 1/8" mtg ctr; cylindrical ceramic 15/16" diam x 3/4" h excluding cont; beryllium copper silver pl cont; miniature type w/metal ctr shield 3/16" diam	Socket for Tube V-301	Elco 169BC	
X-302		SOCKET, ceramic: same as X-301	Socket for tube V-302		
X-303		SOCKET, tube: same as X-103	Socket for V-303		
X-304		SOCKET, tube: same as X-103	Socket for V-304		
X-305		SOCKET, tube: same as X-103	Socket for V-305		
X-306		SOCKET, tube: same as X-101	Socket for V-306		
X-307		SOCKET, tube: same as X-103	Socket for V-307		
Z-301		NETWORK, pulse forming: 259 mh inductance; no dimension greater than 1"; 250 turns of #38 single nylon covered enamel wire wound on JAN type RC20BF332J resistor	Acts as damped peaking coil at minimum delay	Transitron B-0109-00474	Transitron B-0109-00474
††Z-302		FILTER, low pass: same as Z-203	Same as Z-203		
††Z-303		FILTER, low pass: same as Z-203	Same as Z-203		
††Z-304		FILTER, low pass: same as Z-203	Same as Z-203		
P-101	8800-032007 R17-P-4455 6Z3150-5	CONNECTOR, plug (female): two "T" shaped cont, polarized; straight type; cylindrical black comp body; 1 29/32" h x 1 17/32" diam; cord hole .296" to .562" diam; w/cord grip; two mtg holes	Terminates one end of power cable assembly W-101	Hubbell 7084	
P-102	8800-114005 R17-P-4457 6Z1727	CONNECTOR, plug (male): two flat tandem blades; straight type; 1 3/4" lg x 1 9/16" diam; cord opening .296" to .562" diam; 10 amps, 250 V; molded plastic body; brass insert; with cord grip	Terminates one end of power cable assembly W-101	Hubbell 7057	
W-101	1600-324759988 R16-AN-CX-337/U 3E6000-337-72	CABLE ASSEMBLY, power: Army-Navy Cable Assy CX-337/U 6'); two #16 AWG stranded conductor, rubber ins, 300 V working, cotton braid, rubber jacket, oval shape, 5/16" x 3/16"; Hubbell #7084 female cont connector on one end, Hubbell #7057 male cont connector on other end	Provides power connector from unit to power source	JAN CX-337/U (6')	
E-205	3300-298296948 R16-A-478 2Z308-273	ADAPTER, connector: Army-Navy UG-273/U; single round male cont; straight type; coaxial adapter BNC Receptacle to UHG receptacle; 1 5/16" lg x 1 1/16" diam; 500 V peak; cylindrical; silver pl brass body	Provides connection between UG-88/U or similar at one end and Navy type 49194 or similar at other end	JAN UG-273/U	Navy Dwg RE49F389
E-206		ADAPTER, connector: same as E-205			
E-207		ADAPTER, connector: same as E-205			
E-208	3300-298296855 R16-A-470 2Z308-201	ADAPTER, connector: Army-Navy UG-201/U; one end male, other end female; one round male, one round female cont; straight type; 1 33/64" lg x 3/4" diam; cylindrical brass; silver pl; polystyrene insert; 5/8"-32 thd mtg	Provides connection between UG-22/U or similar at one end and UG-88/U or similar at other end	JAN UG-201/U	Navy Dwg RE49F389

TABLE 6-1—TABLE OF REPLACEMENT PARTS

MODEL: SIGNAL GENERATOR TS-418/U and TS-418A/U **MAJOR ASSEMBLY:** SIGNAL GENERATOR TS-418/U and TS-418A/U

Reference Symbol	AF Stock Number Navy Stock Number Army Stock Number	Name of Part and Description	Function	Mfr. and Desig. or JAN Type	Contr. or Gov't. Dwg. or Spec. No.
E-209		ADAPTER, connector: same as E-208	Same as E-208		
E-210		ADAPTER, connector: same as E-208	Same as E-208		
E-211	3300-298296928 R16-A-507 2Z308-255	ADAPTER, connector: Army-Navy UG-255/U; RF coaxial adapter; female one end; male other end; round cont one male, one female straight type; 1 5/16" lg x 5/8" diam; 500 V peak; cylindrical; silver pl brass body	Provides connection between UG-290/U or similar at one end and Navy type 49194 or similar at other end	JAN UG-255/U	Navy Dwg RE49F378
E-212		ADAPTER, connector: same as E-211	Same as E-211		
E-213		ADAPTER, connector: same as E-211	Same as E-211		
P-201	8850-468450 R16-P-3627-375	CONNECTOR: Army-Navy UG-88/U; single male cont; straight type 1" lg x 9/16" diam; cylindrical, silver pl brass body; cable opening 1/4" diam; polystyrene inser*	Terminates one end of RF transmission line W-201	JAN UG-88/U	Navy Dwg RE49F246
P-202		CONNECTOR: same as P-201	Terminates one end of RF transmission line W-201	JAN UG-88/U	Navy Dwg RE49F246
R-206		RESISTOR, thermal: same as R-204	Same as R-204		
W-203	1600-322981537 3E6015-546.3	LINE, RF transmission: Army-Navy Transmission Line CG-546/U; Army-Navy RF Cable RG-55/U; 6' lg excluding terminations; 6' 2" lg o/a; Army-Navy connector UG-88/U at each end; p/o Signal Generator TS-418/U	Output RF signal coaxial transmission line	JAN CG-546/U (6' 0")	JAN-C-17A and Connector UG-88/U
E-326		LAMP, incandescent: same as E-107	Spare lamp		
E-327		LAMP, incandescent: same as E-107	Spare lamp		
E-328		LAMP, incandescent: same as E-107	Spare lamp		
F-305		FUSE, cartridge: same as F-101	Spare fuse		
F-306		FUSE, cartridge: same as F-101	Spare fuse		
F-307		FUSE, cartridge: same as F-101	Spare fuse		
P-301		CONNECTOR: same as P-201	Terminates one end of RF transmission line W-301		
P-302		CONNECTOR: same as P-201	Terminates one end of RF transmission line W-301		
P-303		CONNECTOR: same as P-201	Terminates one end of RF transmission line W-302		
P-304		CONNECTOR: same as P-201	Terminates one end of RF transmission line W-302		

		RESISTOR, thermal: same as R-204	Same as R-204		
		RESISTOR, thermal: same as R-349	Same as R-349		
		RESISTOR, thermal: same as R-355	Same as R-355		
W-301	1600-322981538 3E6015-546.4	LINE, RF transmission: Army-Navy Transmission Line CG-546/U; Army-Navy Cable RG-55/U; 8' lg excluding terminations; 8' 2" o/a; Army-Navy Connector UG-88/U at each end; p/o Signal Generator TS-418/U	Provides connections to J-302, J-303, J-304, J-305	JAN CG-546/U (8' 0")	
W-302		LINE, RF transmission: same as W-301	Same as W-301		
		CASE: protective transit case; aluminum case with balsa wood between inner and outer walls; empty; 20 3/16" lg x 17 1/8" wd x 17" h; has accessories box mtd inside cover, rubber bumpers inside case and cover to cushion equipment, holders for cables and instruction books on inner side walls of case; two (2) folding type handles located on ends; p/o Signal Generator TS-418/U	Transit case for instrument and accessories	Transitron C-0109-00357	Transitron C-0109-00357

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